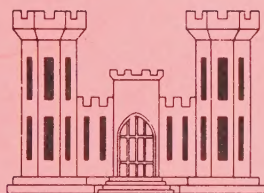


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SAN FRANCISCO BAY AREA IN-DEPTH STUDY

NEW FACILITY ANALYSIS



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SAN FRANCISCO BAY AREA
IN-DEPTH STUDY

NEW FACILITY ANALYSIS

TABLE OF CONTENTS

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
	INTRODUCTION	
1	AUTHORIZING LEGISLATION	1
2	STUDY OBJECTIVE	1
4	PURPOSE	2
	PORT FACILITY CAPABILITY	
5	INTRODUCTION	2
9	CAPABILITY OF EXISTING AND UNDER CONSTRUCTION FACILITIES	3
	WATERBORNE COMMERCE PROJECTIONS	
12	INTRODUCTION	4
14	PACIFIC BASIN COMMODITY FLOW STUDY	6
15	BAY REGION COMMODITY FLOW PROJECTIONS	6
	NEW FACILITY REQUIREMENTS	
19	INTRODUCTION	8
22	BREKBUK CARGO	11
	a. San Francisco Bay Area	11
	b. Delta Area	11
23	CONTAINER/LASH CARGO	12

TABLE OF CONTENTS (Cont'd)

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
24	DRY BULK CARGO	12
	a. San Francisco Bay Area	13
	b. Delta Area	13
25	LIQUID BULK CARGO	14
	a. San Francisco Bay Area	14
	b. Delta Area	14
NEW FACILITY ANALYSIS		
26	INTRODUCTION	15
32	CONTAINER/LASH TERMINALS - MEDIUM PROJECTION	16
40	CONTAINER/LASH TERMINALS - LOW PROJECTION	21
41	CONTAINER/LASH TERMINALS - HIGH PROJECTION	21
43	BREKBUK TERMINALS	24
44	DEVELOPMENT SCENARIOS	24
	a. San Francisco Bay Area - Medium Projection	26
	b. San Francisco Bay Area - Low Projection	26
	c. San Francisco Bay Area - High Projection	29
	d. Delta Area - Medium Projection	31
	e. Delta Area - Low Projection	31
	f. Delta Area - High Projection	31
45	DRY BULK TERMINALS	33
46	DEVELOPMENT SCENARIOS	33
	a. San Francisco Bay Area - Medium Projection	35
	b. San Francisco Bay Area - Low Projection	38
	c. San Francisco Bay Area - High Projection	38
	d. Delta Area - Medium Projection	41
	e. Delta Area - Low Projection	43
	f. Delta Area - High Projection	43
47	LIQUID BULK TERMINALS	44
	a. San Francisco Bay Area	44
	b. Delta Area	49

TABLE OF CONTENTS (Cont'd)

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
NAVIGATION CHANNEL REQUIREMENTS		
48	NAVIGATION OVERVIEW	49
49	AUTHORIZED STUDIES	50
	a. San Francisco Bay Area	50
	b. Delta Area	52
FUTURE STUDIES		
50	FUTURE STUDIES	52
51	TRANSPORTATION SYSTEMS ASSESSMENT	52
52	ENVIRONMENTAL ASSESSMENT	53
53	SOCIO-ECONOMIC ASSESSMENT	53
54	NATIONAL DEFENSE ASSESSMENT	53
55	INSTITUTIONAL ASSESSMENT	54

LIST OF PLATES

<u>No.</u>	<u>Title</u>
1	SAN FRANCISCO BAY REGION
2	PORT FACILITIES AT SAN FRANCISCO, CALIFORNIA
3	PORT FACILITIES AT REDWOOD CITY, CALIFORNIA
4	PORT FACILITIES AT OAKLAND AND ALAMEDA, CALIFORNIA
5	PORT OF OAKLAND-POTENTIAL NORTH HARBOR DEVELOPMENT

TABLE OF CONTENTS (Cont'd)

LIST OF PLATES
(Cont'd)

<u>No.</u>	<u>Title</u>
6	PORT FACILITIES AT RICHMOND, CALIFORNIA
7	PORT FACILITIES ON SAN PABLO BAY, CARQUINEZ AND MARE ISLAND STRAITS, CALIFORNIA
8	PORT OF BENICIA - POTENTIAL PORT DEVELOPMENT
9	PORT FACILITIES ON THE WESTERN SACRAMENTO-SAN JOAQUIN DELTA, CALIFORNIA
10	SACRAMENTO RIVER-DEEP WATER SHIP CHANNEL, CALIFORNIA
11	PORT OF SACRAMENTO
12	PORT FACILITIES AT STOCKTON, CALIFORNIA
13	SAN FRANCISCO BAY
14	SAN FRANCISCO BAY TO STOCKTON

LIST OF APPENDICES

APPENDIX

A	DEEPDRAFT WATERBORNE COMMERCE
B	NEW FACILITY REQUIREMENTS

SAN FRANCISCO BAY AREA
IN-DEPTH STUDY

NEW FACILITY ANALYSIS

INTRODUCTION

1. AUTHORIZING LEGISLATION

The San Francisco Bay Area In-Depth Study was authorized pursuant to a resolution adopted by the Committee on Public Works, House of Representatives, on 19 October 1967 (Navigation Docket No. 1635).

2. STUDY OBJECTIVE

The objective of the study is to prepare guidelines for alternative regional plans to accommodate waterborne commerce in the San Francisco Bay Region within the context of needs for environmental protection and enhancement and general community well-being. The output of the comprehensive investigations contemplated in the study will be a series of navigation development alternatives for different levels of commerce, together with their physical, financial, environmental, and social implications. The array of alternatives is to range from those favorable to the environment and social well-being to those favorable to economic development of the Bay Region. The guidelines for alternative regional navigation plans will be presented in a manner that could be translated into specific programs or projects.

3. To date four reports have been published, including:

- a. Channels, Ports and Related Facilities Inventory, June 1973.
- b. Institutional Inventory, in draft form, November 1974.
- c. Port Facilities Capability Study, January 1976.
- d. Waterborne Commerce Projections and Commodity Flow Analysis

For the San Francisco Bay Region, in draft form, November 1975.

4. PURPOSE

The purpose of this report is to integrate projected commodity flow movements with the throughput capability of existing and planned port facilities and then translate the need for new marine terminal facilities into site specific alternatives. This report represents the initial effort in evaluating future facility requirements to accommodate projected commodity movements, and will serve as the baseline upon which to conduct the impact assessment studies. These impact studies will provide the basis for evaluating and selecting alternative port systems, including consideration of engineering and environmental feasibilities.

PORT FACILITY CAPABILITY

5. INTRODUCTION

In order to evaluate the need for new terminal facilities to meet future waterborne commerce movement requirements, it was first necessary to determine the cargo handling capability of existing and under construction port facilities. To do this, an extensive study was made of the operational characteristics of the ports located in the study area.

6. Commercial ports within the Bay and Delta port complex are located at San Francisco, Redwood City, Oakland, Alameda, Richmond, Benicia, Sacramento and Stockton. The location of these ports is shown on Plate 1. In addition, numerous private terminals and harbor facilities are located throughout the port complex, including the petroleum transfer docks and wharves along the shores of San Pablo Bay, Mare Island Strait, Carquinez Strait and Suisun Bay.

7. The throughput capability, as presented in this report, is defined as the "maximum practical capacity" of the port facilities to move waterborne commerce. The criteria developed to evaluate this capability is based on both the physical components of the system and the economic factors associated with the operation of the port complex. Economic factors that would tend to reduce cargo throughput have been evaluated and incorporated into the criteria such that the cargo throughput is considered to be the maximum that can be economically achieved.

8. The general criteria that were developed to assess cargo handling capability are delineated in the Port Facilities Capability Study report (see Paragraph 3c). General criteria were established for the various cargo handling modes (i.e., general, container, dry bulk and liquid bulk) as to their potential capability to move cargo. The general criteria were applied to the same facility types and adjusted for individual site conditions. In this manner each similar mode of operation in the study area was evaluated against the same set of standards. It was assumed that present methods of operation (e.g., container stacking versus containers on chassis) at individual sites would continue to be used.

9. CAPABILITY OF EXISTING AND UNDER CONSTRUCTION FACILITIES

In order to evaluate the type of facilities required to handle projected waterborne commerce it was first necessary to separate the facilities by area, then by mode of handling. The port facilities in the San Francisco Bay Region were separated into two distinct areas. The "San Francisco Bay Area" is comprised of the ports of San Francisco,

Redwood City, Alameda, Oakland, Richmond, and the port facilities on San Pablo Bay, Carquinez and Mare Island Straits. The "Delta Area" includes the ports of Sacramento and Stockton, and the port facilities on the Western Sacramento-San Joaquin Delta.

10. For those facilities that handle dry and liquid bulk commodities it is necessary to further separate port facilities by commodity group, since, in most cases, each facility is designed for a specific commodity, such as grain or petroleum products.

11. Table 1 summarizes the capability of port facilities in the San Francisco Bay Region to handle waterborne commerce. For details, refer to the report, Port Facilities Capability Study, January 1976. Container/LASH capacities for the Delta are not included since this mode of movement constitutes an internal shipment or receipt to the Bay ports, from where it is loaded on or off deep draft vessels.

WATERBORNE COMMERCE PROJECTIONS

12. INTRODUCTION

The commodity flow analysis was undertaken to provide a range of potential waterborne commerce projections by commodity groups. The projections provide the basic data for evaluation by other studies within the overall In-Depth Study. All waterborne commodities are included in this study with the exception of crude petroleum, inland waterways traffic (primarily sand, gravel and crushed rock, and fresh fish and other marine products), and Department of Defense controlled cargo and special category items. Crude petroleum has been separately analyzed in the Corps' West Coast Deepwater Port Facilities Study, prepared jointly by the South Pacific and North Pacific Divisions in June 1973.

TABLE 1
PRACTICAL MAXIMUM CAPACITY
FACILITIES AS OF 1980
(Thousands of short tons per year)

<u>METHODS OF HANDLING (Commodity Group)</u>	<u>SAN FRANCISCO BAY AREA</u>	<u>DELTA AREA</u>	<u>TOTAL, SAN FRANCISCO BAY REGION</u>
Breakbulk			
General	5,440	1,180	6,620
Heavy-lift <u>1/</u>	640	890	1,530
Subtotal	6,080	2,070	8,150
Container/LASH	10,000	-	10,000
Dry Bulk			
Farm products	720	1,260	1,980
Metallic ores	650	2,780	3,430
Coal and non-metallic minerals	1,510	1,080	2,590
Food	1,000	250	1,250
Lumber	-	1,000	1,000
Stone, clay	500	-	500
Primary metals	460	520	980
Waste, scrap	1,650	650	2,300
Subtotal	6,490	7,540	14,030
Liquid Bulk <u>2/</u>			
Food	810	380	1,190
Chemicals	-	200	200
Petroleum products	26,700	1,830	28,530
Subtotal	27,510	2,410	29,920
TOTAL (Rounded)	50,100	12,000	62,100

1/ Logs, lumber, and transportation equipment.

2/ Excludes crude petroleum.

13. The methodology used to derive the waterborne commerce projections is detailed in the November 1975 draft report entitled, Waterborne Commerce Projections and Commodity Flow Analysis for the San Francisco Bay Region, prepared by the South Pacific Division.

14. PACIFIC BASIN COMMODITY FLOW STUDY

The San Francisco Bay Area In-Depth commodity flow analysis presented in this report represents an initial step of a larger effort. The Corps' three Pacific Divisions are conducting a joint study of commodity flows between the West Coast of the United States and the Pacific Basin. The Pacific Basin Study will analyze origins and destinations of waterborne commerce. This information will be used to firm-up commodity flow data of the In-Depth Study. Also, long term projections in a competitive framework will be made for major port systems on the West Coast, including Puget Sound, the Columbia River, the San Francisco Bay Region, Southern California and Hawaiian ports. The final report for the Pacific Basin Study is scheduled for April 1977.

15. BAY REGION COMMODITY FLOW PROJECTIONS

An analysis was made of each mode of commodity movement. The four methods of shipping considered are breakbulk, containers/LASH, dry bulk, and liquid bulk. The modal split for projected tonnage was separately evaluated for the San Francisco Bay and Delta systems. In general, the modal analysis was made concurrently with the tonnage projection.

16. The historical commodity tonnage, by type of movement, for the San Francisco Bay and Delta Ports for the calendar year 1972 is shown on Table 2. The source for this data was the Waterborne Commerce of the United States, Part IV, Waterways and Harbors Pacific Coast, Alaska and Hawaii.

TABLE 2

DEEPDRAFT WATERBORNE COMMERCE
 SAN FRANCISCO BAY REGION 1/
 (Thousands of short tons)

	<u>CONTAINER/ LASH</u>	<u>BREAK BULK</u>	<u>DRY BULK</u>	<u>LIQUID BULK</u>	<u>TOTAL (Rounded)</u>
1972	2,886	3,783	4,729	14,969	26,400
<u>HIGH</u>					
1980	6,800	4,480	9,000	13,000	33,300
2000	23,600	5,730	24,200	13,800	67,300
2020	41,500	9,620	48,200	17,800	117,000
<u>MEDIUM</u>					
1980	5,940	3,760	7,410	11,600	28,700
2000	18,900	4,280	16,300	8,920	48,400
2020	32,000	6,410	30,400	9,160	78,000
<u>LOW</u>					
1980	5,190	3,160	6,040	11,000	25,400
2000	14,700	3,030	9,120	5,950	32,800
2020	24,100	3,720	14,500	5,040	47,400

1/ Includes Delta Ports

17. The projection series for the San Francisco Bay and Delta Ports are also shown in Table 2. Tables are provided in Appendix A delineating both the 1972 data and the projections for each of the sub-areas, i.e., San Francisco Bay Ports and Delta Ports.

18. These projections were utilized in evaluating the extent and need for expansion and improvement of waterborne commerce facilities in the study area. For planning purposes the medium projections have been used as the baseline series. The high and low projections have been considered in terms of a sensitivity analysis.

NEW FACILITY REQUIREMENTS

19. INTRODUCTION

This section of the report will analyze the need for new facilities and translate that need into berthing requirements. New marine terminal facility requirements were determined by integrating the waterborne commerce projections with the cargo handling capability of existing (as of 1980) facilities. In determining the number of new berths required it was assumed that existing facilities would be operating at 90 percent of their theoretical capacities, as presented in Table 1, and, that the annual throughput used to evaluate each mode of handling is based on existing facility capability.

20. For the purposes of this report, no forecast of technology advances has been made. Therefore, the berthing requirements presented in Tables 3 and 4 are considered to be "equivalent" berths, based on existing technology. Also not included are the number of new berths that will be

TABLE 3

NEW FACILITY REQUIREMENTS
MEDIUM PROJECTION
(Number of Berths) 1/

<u>METHOD OF HANDLING</u>	<u>TOTAL AS OF 1980 2/</u>	<u>INCREMENTAL REQUIREMENTS</u>			<u>TOTAL AS OF 2020</u>
		<u>1980</u>	<u>2000</u>	<u>2020</u>	
<u>San Francisco</u>					
<u>Bay Area</u>					
Breakbulk	57	0	2	3	62
Container/LASH	22	0	19	26	67
Dry Bulk	18	1	4	8	31
Liquid Bulk	<u>22</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>23</u>
Subtotal	119	1	25	38	183
<u>Delta Area</u>					
Breakbulk	11	0	0	0	11
Container/LASH	-	-	-	-	-
Dry Bulk	8	1	3	6	18
Liquid Bulk	<u>7</u>	<u>4</u>	<u>0</u>	<u>0</u>	<u>11</u>
Subtotal	26	5	3	6	40
TOTAL BERTHS	145	6	28	44	223

1/ Based on existing technology.

2/ Includes berths which are presently under construction as well as those considered likely to be operational by 1980.

TABLE 4

NEW FACILITY REQUIREMENTS
 RANGE OF PROJECTIONS 1/
 (Number of Berths) 2/

<u>METHOD OF HANDLING</u>	<u>TOTAL AS OF 1980 3/</u>	<u>INCREMENTAL REQUIREMENTS</u>			<u>TOTAL AS OF 2020</u>
		<u>1980</u>	<u>2000</u>	<u>2020</u>	
<u>San Francisco</u>					
<u>Bay Area</u>					
Breakbulk	57	0-1	1-2	3-8	61-68
Container/LASH	22	0	11-28	18-35	51-85
Dry Bulk	18	1-1	1-9	3-14	23-42
Liquid Bulk	<u>22</u>	<u>0</u>	<u>0-1</u>	<u>1-1</u>	<u>23-24</u>
Subtotal	119	1-2	13-40	25-58	158-219
<u>Delta Area</u>					
Breakbulk	11	0	0-1	0-13	11-25
Container/LASH	-	-	-	-	-
Dry Bulk	8	1-1	0-7	2-10	11-26
Liquid Bulk	<u>7</u>	<u>4-4</u>	<u>0</u>	<u>0</u>	<u>11-11</u>
Subtotal	26	5-5	0-8	2-23	33-62
TOTAL BERTHS	145	6-7	13-48	27-81	191-281

1/ Based on "LOW" and "HIGH" waterborne commerce projections.

2/ Based on existing technology.

3/ Includes berths which are presently under construction as well as those considered likely to be operational by 1980.

required to replace existing facilities that become obsolete and/or are modernized for other modes of cargo handling. This subject will be addressed in subsequent sections of this report as the alternative port systems are presented.

21. The numbers presented in Table 3 summarize the berthing requirements, assuming that the "medium" waterborne commerce projection tonnages are realized. An upper and lower range, using the "high" and "low" projections is presented in Table 4, and serves as an indication of the sensitivity of berthing requirements relative to assumed commodity projection levels. A detailed analysis of future berthing requirements is presented in Appendix B.

22. BREAKBULK CARGO

For the purpose of analysis this mode of shipping has been separated into two categories, "general" cargo and "heavy-lift" cargo: with general cargo consisting of those commodities shipped in package form like bales, bags, barrels, and boxes; and heavy-lift cargo consisting principally of automobiles, logs, and lumber. In analyzing new berth requirements annual throughputs of 100,000 short tons for general cargo berths and 180,000 short tons for heavy-lift terminals was assumed.

a. San Francisco Bay Area. The requirement for new berthing facilities in 1980 and 2000 are in the "heavy-lift category". Only with the "high" projection will new general cargo berths be needed, and then, not until 2020.

b. Delta Area. In the Delta Area the berthing requirements consist solely of general cargo terminals, with the greatest need indicated to handle 2020 cargo.

23. CONTAINER/LASH CARGO

This analysis is concerned only with deepwater port facilities, and, as such the only container/LASH terminals considered are in the San Francisco Bay Area. No projections of internal waterborne commerce were made. Since the container/LASH barge service to and from the Delta Ports constitutes an internal movement of cargo, these facilities were not specifically analyzed. New berthing requirements are based on annual throughputs of 570,000 short tons per berth. As indicated in Tables 3 and 4, existing and under construction container terminals are adequate to accommodate projected 1980 waterborne commerce. New container and LASH berths are expected to be needed beginning about 1985, based on the "medium" projection.

24. DRY BULK CARGO

As was previously indicated bulk cargo terminals are generally designed to handle specific commodity groups. It was thus necessary to evaluate each "type" of terminal separately. The specific dry bulk terminals that were considered are indicated in Table 1. In evaluating berthing requirements the following annual throughputs were assumed.

<u>Commodity Group</u>	<u>Annual throughput (1,000 short tons per year)</u>
Farm products	500
Metallic ores	1,500
Coal & non-metallic minerals	1,500
Food	1,000
Lumber	1,000
Stone, clay	500
Primary metals	750
Waste, scrap	500

a. San Francisco Bay Area. In this portion of the study area there are two types of dry bulk terminals that have sufficient capacity to handle projected 2020 tonnages, these being "farm products" and "stone and clay". The "farm products" group is composed of grains, such as rice, corn, and oats, while "stone and clay" includes building cement, lime, and other such materials. Bulk ore terminals are capable of handling many different types of materials, requiring only some means of separation in the storage area. For this reason the "metallic ores" and "coal and non-metallic minerals" groups were lumped together for purpose of determining future berthing requirements. The "food" grouping for the San Francisco Bay Area consists of sugar, and the berthing requirements are related to plant capacity. With a moderate plant expansion some additional cargo can be handled at the present facility. New facilities will be required for any extensive plant expansion. The "primary metals" commodity group consists of petroleum coke and will require additional berthing facilities in the 1980 time frame for all levels of projections. The remaining group which will require additional berthing facilities is "waste and scrap", although not until after 1980.

b. Delta Area. The commodity which comprises the "food" grouping in the Delta Area is prepared animal feeds. Since this commodity can be handled through grain elevators, "farm products" and "food" were combined for purposes of determining berth requirements. As with the San Francisco Bay Area, "metallic ores" and "coal and non-metallic minerals" were analyzed as one unit. The dry bulk commodity comprising the "lumber"

group is wood chips. The other commodity group requiring future berthing facilities is the "primary metals". All of the commodities listed under "stone and clay" are transported by barges and are considered to be internal waterways traffic.

25. LIQUID BULK CARGO

As with dry bulk terminals, liquid bulk facilities are typically single commodity handlers. The three commodity groupings evaluated include "food", "chemicals" and "petroleum products". Historically, paper pulp, in slurry form, was included in this category. The processing plant, which is located in Antioch, was recently converted into a recycling operation and will no longer require pulp in the slurry form for the manufacture of its products.

a. San Francisco Bay Area. Liquid bulk terminals for "petroleum products" and "chemicals" in the San Francisco Bay Area are adequate for projected 2020 waterborne commerce. Additional berths will be necessary to handle bulk liquid "food" products. An annual throughput of 500,000 short tons was assumed in the new berth analysis for this product.

b. Delta Area. Berthing needs in the Delta Area are associated with "chemicals" and "petroleum products", and based principally on the anticipated expansion of the Dow Chemical Plant at Pittsburg, and the Arco Chemical Plant in the vicinity of Rio Vista. Facilities for the throughput of liquid bulk "food products" are considered to be adequate to meet projected commerce.

NEW FACILITY ANALYSIS

26. INTRODUCTION

This section identifies development scenarios based on the new facility requirements for each of the commodity groups. In each case the "medium" commodity projection was used to develop the scenario. The "low" and "high" waterborne commerce projections were evaluated in terms of how they modify the development scheme. The siting of terminal facilities at individual ports followed generally the master plan developed by that port.

27. In general, physical and environmental constraints were not considered in siting new port developments. For example, if a deeper channel is required to accommodate projected cargo movement, it will be assumed, at this point of the planning process, that this channel can be deepened even though it may later be proven engineeringly impractical and environmentally undesirable. This report is intended to serve as a basis for conducting the impact assessment studies, and, as such, has attempted to identify all potential port development sites. Subsequent impact assessments studies will provide the basis for evaluating and selecting alternative port systems including consideration of engineering and environmental feasibilities.

28. The phasing of the various terminal facilities into the development scheme was accomplished on the basis of which developments were "more likely" to be constructed before others. For example, facilities requiring only expansion and modernization were given a higher priority than a completely new facility requiring major land fill.

29. The allocation of projected waterborne commerce to specific port areas was accomplished by assuming that existing terminals received the first allocation (up to 90% of practical maximum capacity), with the remaining tonnage apportioned (with respect to cargo handling capacity) to the new berths considered "most likely" to be developed in that time frame.

30. In evaluating new berthing requirements it was found that of the four modes of cargo handling the container/LASH mode requires the greatest number of new berths, as is indicated in Table 3. For this reason container/LASH terminals will be analyzed first.

31. In analyzing potential sites for container/LASH terminals it was determined that each of the levels of waterborne commerce projections could be accommodated. The allocation of projected container/LASH tonnage associated with each of the development schemes is presented in Table 5. The specific facilities to be developed to meet the needs are presented in Table 6 (medium), Table 7 (low) and Table 8 (high); and are discussed in the following paragraphs.

32. CONTAINER/LASH TERMINALS-MEDIUM PROJECTION

Since only deepwater port facilities are being considered in this analysis and the container/LASH movement of waterborne commerce to Delta Area ports is considered to be an internal movement, this mode of cargo handling is associated only with the San Francisco Bay Area portion of the study area. Table 6 indicates the time frame in which new berthing facilities will be required and port areas with the potential to satisfy the needs.

TABLE 5

ALLOCATION OF PROJECTED
CONTAINER/LASH CARGO 1/
(1,000 Short Tons per year)

PORT AREA	MEDIUM			LOW			HIGH		
	<u>1980</u>	<u>2000</u>	<u>2020</u>	<u>1980</u>	<u>2000</u>	<u>2020</u>	<u>1980</u>	<u>2000</u>	<u>2020</u>
SAN FRANCISCO	1,200	3,100	9,200	1,050	2,600	6,300	1,380	6,100	11,300
OAKLAND	4,340	9,700	11,700	3,790	9,600	11,700	4,980	11,600	18,900
ALAMEDA	100	1,000	1,000	90	500	1,000	110	900	1,000
RICHMOND	300	5,100	5,100	260	2,000	5,100	340	5,000	5,100
SAN PABLO BAY	<u>-</u>	<u>-</u>	<u>5,000</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>5,200</u>
TOTAL	5,940	18,900	32,000	5,190	14,700	24,100	6,810	23,600	41,500

1/ Allocation of waterborne commerce based on berthing facilities operating at 90% of practical maximum capacity.

TABLE 6

CONTAINER/LASH CARGO HANDLING CAPABILITY
PRACTICAL MAXIMUM CAPACITY
(1,000 Short tons per year)

PORT AREA	1980		2000		2020	
	BERTHS	CAPACITY	BERTHS	CAPACITY	BERTHS	CAPACITY
SAN FRANCISCO	6	2,370	8 <u>1/</u>	3,510	18 <u>5/</u>	10,260
OAKLAND	14	6,700	21 <u>2/</u>	10,690	25 <u>6/</u>	12,970
ALAMEDA	1	380	2 <u>3/</u>	1,140	2	1,140
RICHMOND	1	570	10 <u>4/</u>	5,700	10	5,700
BENICIA	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>8</u>	<u>5,760</u>
TOTAL	22	10,020	41	21,040	63	35,830

1/ Two berths at Pier 94.

2/ Two berths at 14th Street; Two berths at Market Street;
Three berths at Ninth Avenue.

3/ Extension to Berth 5 and expansion of existing storage area.

4/ Three berths at Terminal No. 3; Six berths at Shipyard No. 3.

5/ One berth at Pier 94; Two berths at Pier 98; Seven berths at
Hunters Point.

6/ Four berths at the Oakland Army Base.

33. The terminal facilities listed in the "1980" column of Table 6 include those berths which are presently under construction as well as those considered likely to be operational by 1980. At the present time there are 17 container berths available in the study area. New berths which are either under construction or in advanced planning stages include three berths in Oakland Outer Harbor; one berth at Pier 94 at the Port of San Francisco; and one berth at the Port of Richmond at Terminal No. 3.

34. New container and LASH berths are expected to be needed beginning about 1985. By the year 2000 an additional 19 berths will be required. Development potential at the Port of San Francisco indicates that an expansion of two berths at Pier 94 can be accommodated (Plate 2). Modernization of the 14th Street Wharf in Oakland Outer Harbor would provide two container berths. Planned expansion and modernization of the Market Street and Ninth Avenue terminals in Oakland Inner Harbor would result in five additional berths (Plate 4). With the extension of the existing container berth at Encinal Terminals in Alameda and an expansion of the present container storage area two full container berths would be available for use (Plate 4). The master plan that is being developed for the Port of Richmond indicates an ultimate development of ten container berths. With the level of waterborne commerce projected, this development potential can be realized by the year 2000 (Plate 6).

35. Based on Table 3 an additional 26 container berths will be required between 2000 and 2020. Table 6 indicates that 22 berths will accommodate the projected waterborne commerce. In determining new facility requirements a standard container berth with an annual throughout capacity of 570,000 short tons was used. In analyzing specific sites it was found that in some instances the cargo handling capability of a particular berthing facility was greater than the standard terminal used to measure new facility requirements, thus reducing the number of berths necessary to handle a given amount of cargo.

36. The potential container terminal areas that have been included in Table 6 to this point have generally been existing facilities requiring expansion and/or modernization. With the exception of one additional berth at the Port of San Francisco Pier 94 (Plate 2), all the new berths indicated in the 2020 column will require varying degrees of land fill to provide wharf frontage and sufficient back-up area for the container storage yard.

37. Potential development at the Port of San Francisco is in two areas, Pier 98 and Hunter's Point (Plate 2). Pier 98 would be located in India Basin, consisting of two berths with approximately 49 acres of land area. The Hunters Point site has a potential for seven berths, with a gross land area of 230 acres. Development of the Hunters Point facility would come about only if the Port can negotiate the purchase of the Naval Shipyard from the U.S. Government.

38. A 4-berth, 156 acre terminal is proposed for the area adjacent to the Oakland Army Base in the Outer Harbor (Plate 4). However, this site is presently not available for development and would not be unless the area is declared surplus by the Military and the Army Base purchased from the U.S. Government.

39. Eight container berths are proposed for the Port of Benicia (Plate 7). Two alternative development plans have been included for the port (Plate 8); with the larger of the two totaling some 455 acres, an area of 310 acres for the smaller. The eight berth facility proposed for the 2020 time frame will require the 455 acre terminal area.

40. CONTAINER/LASH TERMINALS-LOW PROJECTION

As would be expected, a lower projected level of waterborne commerce shifts the requirement for new terminal facilities further out on the time scale (Table 4). Table 7 indicates the sequence of development using the "low" projection. In terms of the development potential at each of the port areas, the net change from the "medium" projection would be the elimination of major land fill areas at the Ports of San Francisco (Pier 98) and Benicia; and the development of four berths at the Hunters Point facility instead of seven.

41. CONTAINER/LASH TERMINALS-HIGH PROJECTION

The development sequence for the "high" projection is shown on Table 8. Using the high level projection would require the construction of fifteen additional container berths over the "medium" projection. Providing these berths would require major land fills at both the Ports of San Francisco and Oakland. Pier 72 at the Port of San Francisco

TABLE 7

CONTAINER/LASH CARGO HANDLING CAPABILITY
PRACTICAL MAXIMUM CAPACITY
(1,000 Short tons per year)

LOW PROJECTION

<u>PORT AREA</u>	<u>1980</u>		<u>2000</u>		<u>2020</u>	
	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>
SAN FRANCISCO	6	2,370	7 <u>1/</u>	2,940	13 <u>5/</u>	6,960
OAKLAND	14	6,700	21 <u>2/</u>	10,690	25 <u>6/</u>	12,970
ALAMEDA	1	380	1	570 <u>3/</u>	2 <u>7/</u>	1,140
RICHMOND	1	570	4 <u>4/</u>	2,280	10 <u>8/</u>	5,700
SAN PABLO BAY	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
TOTAL	22	10,020	33	16,480	50	26,770

1/ One berth at Pier 94.

2/ Two berths at 14th Street; Two berths at Market Street;
Three berths at Ninth Avenue.

3/ Expansion of existing storage area.

4/ Three berths at Terminal No. 3.

5/ Two berths at Pier 94; Four berths at Hunter's Point.

6/ Four berths at Oakland Army Base.

7/ Extension to Berth 5.

8/ Six berths at Shipyard No. 3.

TABLE 8

CONTAINER/LASH CARGO HANDLING CAPABILITY
PRACTICAL MAXIMUM CAPACITY
(1,000 Short tons per year)

HIGH PROJECTION

<u>PORT AREA</u>	<u>1980</u>		<u>2000</u>		<u>2020</u>	
	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>
SAN FRANCISCO	6	2,370	13 <u>1/</u>	6,960	22 <u>5/</u>	12,540
OAKLAND	14	6,700	25 <u>2/</u>	12,970	36 <u>6/</u>	20,890
ALAMEDA	1	380	2 <u>3/</u>	1,140	2	1,140
RICHMOND	1	570	10 <u>4/</u>	5,700	10	5,700
SAN PABLO BAY	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>8 7/</u>	<u>5,760</u>
TOTAL	22	10,020	50	26,770	78	46,030

1/ Three berths at Pier 94; Four berths at Hunters Point.

2/ Two berths at Market Street; Three berths at Ninth Avenue;
Four berths at the Oakland Army Base; Two berths at 14th Street.

3/ Extension to Berth 5 and expansion of existing storage area.

4/ Three berths at Terminal No. 3; Six berths at Shipyard No. 3.

5/ Two berths at Pier 98; Three berths at Pier 72; One berth at Pier 56;
Three berths at Hunters Point.

6/ Eleven berths at North Harbor.

7/ Eight berths at Benicia.

would be a combination breakbulk-container terminal with three berths for containers and one berth for handling automobiles (Plate 2). Pier 56 would also be a multiple use facility with one berth for container cargo and the remaining three for breakbulk and heavylift general cargo.

42. Included in the Port of Oakland's Master Plan is the North Harbor development, located to the north of the San Francisco Bay Bridge (Plate 5). This site would provide a 450 acre area serving eleven berths.

43. BREAKBULK TERMINALS

In analyzing new facility requirements for container/LASH cargo in the "San Francisco Bay Area" portion of the study area six breakbulk terminals were assumed to be redeveloped and modernized for use as container terminals. This has the affect of reducing the annual cargo throughput capacity for "general" breakbulk by 635,000 short tons. With respect to Table 3 (medium projection), there is no change in the incremental requirement of two breakbulk berths by 2000 and three by 2020, which are for "heavy-lift cargo. The change in Table 4 is for the high projection for the 2020 time frame, with a total of 14 additional berths required rather than the eight indicated. Since no deepdraft container terminals were sited in the "Delta Area", breakbulk facility requirements remain the same as shown on Tables 3 and 4.

44. DEVELOPMENT SCENARIOS

As is indicated in Table 9, the projected breakbulk waterborne commerce for each level can be accommodated. Tables 10, 11, and 12 show the proposed development scheme for the "medium," "low," and "high" projections, respectively.

TABLE 9

ALLOCATION OF PROJECTED
BREAKBULK CARGO 1/
(1,000 Short tons per year)

PORT AREA	MEDIUM			LOW			HIGH		
	1980	2000	2020	1980	2000	2020	1980	2000	2020
<u>SAN FRANCISCO BAY AREA</u>									
SAN FRANCISCO	2,150	2,450	3,600	1,850	1,900	2,300	2,490	2,970	5,350
REDWOOD CITY	40	50	60	30	40	50	40	50	140
OAKLAND	890	620	910	770	480	590	1,030	760	890
ALAMEDA	240	280	410	210	220	260	280	340	340
RICHMOND	30	-	-	30	30	-	30	-	-
SAN PABLO BAY	<u>70</u>	<u>80</u>	<u>100</u>	<u>60</u>	<u>70</u>	<u>80</u>	<u>80</u>	<u>90</u>	<u>110</u>
TOTAL	3,420	3,480	5,080	2,950	2,740	3,280	3,950	4,210	6,830
<u>DELTA AREA</u>									
WESTERN SAC.-S.J.	100	230	370	60	80	130	150	440	700
SACRAMENTO	60	130	270	40	50	70	90	260	810
STOCKTON	<u>180</u>	<u>440</u>	<u>690</u>	<u>120</u>	<u>160</u>	<u>240</u>	<u>280</u>	<u>820</u>	<u>1,290</u>
TOTAL	340	800	1,330	220	290	440	520	1,520	2,800

1/ Allocation of waterborne commerce based on berthing facilities operating at 90% of practical maximum capacity.

a. San Francisco Bay Area - Medium Projection. The requirement for breakbulk terminal facilities in 2000 and 2020 are in the heavy-lift category. Commodities listed in this group include lumber and wood products, and transportation equipment (i.e., automobiles). To satisfy this need the problem can be approached from two directions. The principle requirement for handling this category of goods is open space for storage. The first approach to the problem is to construct additional berths over which to move this type of waterborne commerce. Assuming that the priority of constructing container berths is greater than that for breakbulk berths, to provide these berths will require major land fill areas. An alternative approach is to assume that if conventional breakbulk berths have excess capacity and, there is sufficient open space in the backup areas of the ports, this cargo can be handled at existing terminal facilities. Since it is desirable to maximize the utilization of existing facilities, the second solution to the problem has been chosen for the purpose of this evaluation. With the excess capacity of the general cargo terminals the requirement for additional heavy-lift berths is reduced to zero for the medium projection. The cargo handling capability for the medium projection is shown on Table 10.

b. San Francisco Bay Area - Low Projection. As was the case for the medium projection, new berthing requirements for 2000 and 2020 are for heavy-lift cargoes. Also as was previously experienced, there is excess general cargo terminal capacity, resulting in no need for constructing additional breakbulk marine terminal facilities. Table 11 indicates the capability of San Francisco Bay Area ports to handle breakbulk cargo.

TABLE 10

BREAKBULK CARGO HANDLING CAPABILITY
PRACTICAL MAXIMUM CAPACITY
(1,000 Short Tons Per Year)

MEDIUM PROJECTION

<u>PORT AREA</u>	<u>1980</u>		<u>2000^{1/}</u>		<u>2020</u>	
	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>
<u>SAN FRANCISCO BAY AREA</u>						
SAN FRANCISCO	39	3,860	39	3,860	39	3,860
REDWOOD CITY	1	80	1	80	1	80
OAKLAND	11	1,570	6 <u>2/</u>	970	6	970
ALAMEDA	4	420	4	420	4	420
RICHMOND	1	30	- <u>3/</u>	-	-	-
SAN PABLO BAY	<u>1</u>	<u>120</u>	<u>1</u>	<u>120</u>	<u>1</u>	<u>120</u>
TOTAL	57	6,080	51	5,450	51	5,450
<u>DELTA AREA</u>						
WESTERN SAC.-S.J	1	600	1	600	1	600
SACRAMENTO	3	360	3	440 <u>4/</u>	3	440
STOCKTON	<u>7</u>	<u>1,110</u>	<u>7</u>	<u>1,110</u>	<u>7</u>	<u>1,110</u>
TOTAL	11	2,070	11	2,150	11	2,150

1/ Adjusted for loss of berths through redevelopment for containerization.

2/ One berth at Grove Street; One berth at Ninth Avenue; Three berths at 14th Street.

3/ One berth at Shipyard No. 3.

4/ Full use of Wharf 7 for breakbulk cargo.

TABLE 11

BREAKBULK CARGO HANDLING CAPABILITY
PRACTICAL MAXIMUM CAPACITY
(1,000 Short Tons Per Year)

LOW PROJECTION

<u>PORT AREA</u>	<u>1980</u>		<u>2000^{1/}</u>		<u>2020^{1/}</u>	
	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>
<u>SAN FRANCISCO BAY AREA</u>						
SAN FRANCISCO	39	3,860	39	3,860	39	3,860
REDWOOD CITY	1	80	1	80	1	80
OAKLAND	11	1,570	6 <u>2/</u>	970	6	970
ALAMEDA	4	420	4	420	4	420
RICHMOND	1	30	1	30	- <u>3/</u>	-
SAN PABLO BAY	<u>1</u>	<u>120</u>	<u>1</u>	<u>120</u>	<u>1</u>	<u>120</u>
TOTAL	57	6,080	52	5,480	51	5,450
<u>DELTA AREA</u>						
WESTERN SAC.-S.J	1	600	1	600	1	600
SACRAMENTO	3	360	3 <u>4/</u>	440	3	440
STOCKTON	<u>7</u>	<u>1,110</u>	<u>7</u>	<u>1,110</u>	<u>7</u>	<u>1,110</u>
TOTAL	11	2,070	11	2,150	11	2,150

1/ Adjusted for loss of berths through redevelopment for containerization.

2/ One berth at Grove Street; One berth at Ninth Avenue; Three berths at 14th Street.

3/ One berth at Shipyard No. 3.

4/ Full use of Wharf 7 for breakbulk cargo.

c. San Francisco Bay Area - High Projection. The incremental requirements for breakbulk berths, using the high projection, are as indicated in the following tabulation:

<u>Cargo Type</u>	<u>Incremental Requirements</u>			<u>Total As of 2020</u>
	<u>1980</u>	<u>2000</u>	<u>2020</u>	
General	0	0	11	11
Heavy-Lift	<u>1</u>	<u>2</u>	<u>3</u>	<u>6</u>
Total	1	2	14	17

In the 1980 and 2000 time frame there is sufficient throughput capacity to eliminate the requirement for the three heavy-lift berths. However, in the 2020 time frame new terminals will be required for both cargo types and a total of 6 heavy-lift berths will be required to handle projected commodity movements. The development scheme for the high projection is shown on Table 12.

(1) Using the Master Plans of each of the ports and taking those areas designated for proposed development, the berthing requirements would be satisfied at two port areas; the Port of San Francisco and the Port of Redwood City. The Port of Redwood City would provide one general cargo berth at Wharf No. 5 (Plate 3). It would utilize an existing dock and require the construction of a 50,000 square foot transit shed.

(2) New facilities at the Port of San Francisco would require the construction of major land fill areas at Pier 56, Pier 48, Pier 20, and Pier 5 (Plate 2). One berth at Pier 56 is already included for handling container cargo. Two additional berths would be designated for general cargo and one for heavy-lift. An extension of the existing Pier 48 terminal would add two general cargo berths.

TABLE 12

BREAKBULK CARGO HANDLING CAPABILITY
PRACTICAL MAXIMUM CAPACITY
(1,000 Short Tons Per Year)

PORT AREA	HIGH PROJECTION					
	1980		2000 ^{1/}		2020	
	BERTHS	CAPACITY	BERTHS	CAPACITY	BERTHS	CAPACITY
<u>SAN FRANCISCO BAY AREA</u>						
SAN FRANCISCO	39	3,860	39	3,860	58 <u>4/</u>	6,300
REDWOOD CITY	1	80	1	80	2 <u>5/</u>	180
OAKLAND	11	1,570	6 <u>2/</u>	970	6	970
ALAMEDA	4	420	4	420	4	420
RICHMOND	1	30	- <u>3/</u>	-	-	-
SAN PABLO BAY	<u>1</u>	<u>120</u>	<u>1</u>	<u>120</u>	<u>1</u>	<u>120</u>
TOTAL	57	6,080	51	5,450	71	7,990
<u>DELTA AREA</u>						
WESTERN SAC.-S.J.	1	600	1	600	4 <u>7/</u>	870
SACRAMENTO	3	360	3	440 <u>6/</u>	9 <u>8/</u>	980
STOCKTON	<u>7</u>	<u>1,110</u>	<u>7</u>	<u>1,110</u>	<u>12</u> <u>9/</u>	<u>1,560</u>
TOTAL	11	2,070	11	2,150	25	3,410

1/ Adjusted for loss of berths through redevelopment for containerization.

2/ One berth at Grove Street; One berth at Ninth Avenue; Three berths at 14th Street.

3/ One berth at Shipyard No. 3.

4/ Three berths at Pier 56; Two berths at Pier 48; Six berths at Pier 40; Four berths at Pier 20; and Four berths at Pier 5.

5/ One berth at Wharf No. 5.

6/ Full use of Wharf 7 for breakbulk cargo

7/ Collinsville-Montezuma Slough Area.

8/ One berth at Wharf 11; Five berths south of turning basin.

9/ Five berths on Rough and Ready Island.

(3) The three other terminal complexes indicated for the Port of San Francisco would require extensive renovation of existing finger piers and major land fills. Pier 40 would provide a total of six berths on a land area of 80 acres (three "general" berths and three "heavy-lift"). The area designated as Pier 20 is 55 acres in size and adds a total of four berths (three "general" and one "heavy-lift"). Although only one heavy-lift cargo berth is required at Pier 5, the other three berths on the 44 acre site can be developed to provide some flexibility in the overall operation of the Port.

d. Delta Area - Medium Projection. As indicated in Table 3, the existing eleven breakbulk berths have sufficient throughput capability to handle the waterborne commerce allocated to the Delta Area under the "MEDIUM" level projection. In this case the heavy-lift cargo terminals have excess capacity, negating the use of excess capacity at general cargo terminals, as was the situation in the San Francisco Bay Area. The cargo handling capability for the medium projection is shown on Table 10.

e. Delta Area - Low Projection. As with the medium projection, 1980 marine terminal facilities are adequate to handle projected waterborne commerce through the 2020 time frame (Table 4). Table 11 presents the cargo handling capability of existing port areas with the low projection.

f. Delta Area - High Projection. Berthing requirements consist solely of general cargo berths, requiring one berth by 2000 and an additional 13 berths by 2020. The development scheme selected to satisfy the need is indicated on Table 12.

(1) The one berth requirement for the 2000 time frame would be partially satisfied at the Port of Sacramento. (Plate 11). At the present time Wharf 7 is used in conjunction with Pier 8 for handling dry bulk commodities. Consequently, the breakbulk throughput at Wharf 7 is operating approximately twenty percent of its potential capacity. With the development of Wharf 8, the full capacity of the berth would be utilized, moving the requirement for the construction of an additional terminal to the 2020 time frame.

(2) A total of 14 breakbulk berths will be required in the 2000 to 2020 time period. Based on an analysis of existing port areas there is a potential of six berths at the Port of Sacramento and five at the Port of Stockton. The Port of Sacramento's Master Plan calls for the development of Wharf 11 for breakbulk cargo. The area on the south side of the turning basin is designated as "future terminal expansion" (Plate 11). With waterfront footage exceeding four thousand feet, five breakbulk berths could be accommodated.

(3) All available deepwater frontage lands now owned by the Stockton Port District are utilized for wharves and piers. Should the terminal facilities of the Naval Communication Center on Rough and Ready Island be declared surplus, the Port would probably acquire at least five wharves and additional backup lands and warehouses (Plate 12).

(4) With the development of eleven berths at the two existing port complexes there remains a need for three berths to handle the anticipated waterborne commerce. This will require the development of new port areas. The San Francisco Bay Plan, developed by the San

Francisco Bay Conservation and Development Commission (BCDC), indicates that the Collinsville-Montezuma Slough area has development potential for water-oriented industries (Plate 9). The development of this area for deep-draft terminal facilities would require the dredging of an access channel from the deep-water shipping channel. A total of three breakbulk berths has been included in the development scheme presented in Table 12.

45. DRY BULK TERMINALS

During the process of siting new container handling facilities four "waste, scrap" berths at the Port of Richmond were assumed to be re-developed and modernized for the handling of containerized cargo. The affect on the new facility requirements presented in Table 3 for the San Francisco Bay Area is to add one dry bulk berth to the 2020 time frame. With the high projection (Table 4) this berth is needed by 2000. There is no change in new facility requirements for the low projection (Table 4). Dry bulk berthing requirements for the Delta Area remain the same as shown in Tables 3 and 4.

46. DEVELOPMENT SCENARIOS

As is indicated in Table 13 there are unmet demands for facilities to handle projected dry bulk cargo for each of the projection levels. The 1980 deficiencies are for the handling of petroleum coke. In each case, it was assumed that the required facilities would be developed in the 1980-2000 time period. In the case of the high projection, for the San Francisco Bay Area, this excess demand for new dry bulk terminal facilities will have to be met in the Delta area. The development schemes for each level of commodity projection are presented in Tables 14, 15 and 16.

TABLE 13

ALLOCATION OF PROJECTED
 DRY BULK CARGO 1/
 (1,000 Short Tons Per Year)

<u>PORT AREA</u>	<u>MEDIUM</u>			<u>LOW</u>			<u>HIGH</u>		
	<u>1930</u>	<u>2000</u>	<u>2020</u>	<u>1980</u>	<u>2000</u>	<u>2020</u>	<u>1980</u>	<u>2000</u>	<u>2000</u>
<u>SAN FRANCISCO BAY AREA</u>									
SAN FRANCISCO	160	100	1,490	130	60	70	190	1,240	1,570
REDWOOD CITY	900	1,620	4,620	780	1,030	1,610	1,080	2,510	4,680
OAKLAND	340	900	910	320	470	940	370	870	900
ALAMEDA	-	-	-	-	-	-	-	-	-
RICHMOND	230	420	410	190	240	310	280	350	680
SAN PABLO BAY	<u>1,740</u>	<u>4,790</u>	<u>8,470</u>	<u>1,560</u>	<u>3,110</u>	<u>4,720</u>	<u>2,040</u>	<u>6,360</u>	<u>14,350</u>
TOTAL	3,370 ^{2/}	7,830	15,900	2,980 ^{3/}	4,910	7,650	3,960 ^{4/}	11,330	22,180 ^{5/}
<u>DELTA AREA</u>									
WESTERN SAC.-S.J.	740	2,320	4,640	700	1,510	1,970	790	2,940	8,110
SACRAMENTO	1,210	3,380	5,510	700	810	1,010	1,730	5,800	12,930
STOCKTON	<u>1,250</u>	<u>2,780</u>	<u>4,320</u>	<u>1,050</u>	<u>1,890</u>	<u>3,830</u>	<u>1,470</u>	<u>4,100</u>	<u>5,020</u>
TOTAL	3,200 ^{6/}	8,480	14,470	2,450 ^{7/}	4,210	6,810	3,990 ^{8/}	12,840	26,060 ^{9/}

1/ Allocation of waterborne commerce based on berthing facilities operating at 90% of practical maximum capacity.

2/ Unmet demand: Projection = 3,770,000 short tons.

3/ Unmet demand: Projection = 3,280,000 short tons.

4/ Unmet demand: Projection = 4,440,000 short tons.

5/ Projection = 25,840 short tons. Difference to be handled by Delta Ports.

6/ Unmet demand: Projection = 3,640,000 short tons.

7/ Unmet demand: Projection = 2,750,000 short tons.

8/ Unmet demand: Projection = 4,560,000 short tons.

9/ Projection = 22,400,000 short tons. Difference from S.F. Bay Area unmet demands.

a. San Francisco Bay Area - Medium Projection. New dry bulk facility requirements are for four commodity groupings: metallic and non-metallic ores; food; primary metals; and, waste and metal scrap. There are six sites in the San Pablo Bay, Carquinez and Mare Island Straits area that have potential for use in handling dry bulk commodities (Plate 7). Bethlehem Steel Company has a terminal facility at Pinole Point that is not now in use. The Hercules Wharf, located between Pinole Point and Davis Point is also not currently in operation. The American Smelting and Refining Company facility at Selby is for sale and has been under consideration for development as a dry bulk cargo handling facility. It is assumed that each of these sites could be developed to provide two dry bulk cargo handling berths. The northeast side of Mare Island Strait, including the Sperry Flour Mill Vallejo Wharf; the Basalt Rock Company Wharf; and, the City of Vallejo Mooring presents ten thousand feet of waterfront property that could be developed for commercial port related uses.

(1) The requirement for one berth by 1980 is for the handling of petroleum coke. This facility would be developed in the 1980 to 2000 time frame and be included in the "2000" column of Table 14. Thus, berthing requirements for 2000 include one berth for handling bulk sugar receipts; three berths for petroleum coke; and one berth for metal scrap. It is assumed that the plant capacity at the California and Hawaiian Sugar Company facility at Crockett would be expanded, thereby eliminating the need for construction of a dock facility (Plate 7).

TABLE 14

DRY BULK CARGO HANDLING CAPABILITY
PRACTICAL MAXIMUM CAPACITY
(1,000 Short Tons Per Year)

MEDIUM PROJECTION

<u>PORT AREA</u>	<u>1980</u>		<u>2000</u>		<u>2020</u>	
	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>
<u>SAN FRANCISCO BAY AREA</u>						
SAN FRANCISCO	1	720	1	720	2 <u>4/</u>	2,220
REDWOOD CITY	4	2,200	4	2,200	6 <u>5/</u>	5,200
OAKLAND	1	500	2 <u>2/</u>	1,000	2	1,000
ALAMEDA	-	-	-	-	-	-
RICHMOND	3 <u>1/</u>	450	3	450	3	450
SAN PABLO BAY	<u>5</u>	<u>2,320</u>	<u>8 3/</u>	<u>5,570</u>	<u>14 6/</u>	<u>9,820</u>
TOTAL	14	6,190	18	9,940	27	18,690
<u>DELTA AREA</u>						
WESTERN SAC.-S.J	2	1,230	4 <u>7/</u>	2,730	7 <u>9/</u>	5,730
SACRAMENTO	3	2,360	5 <u>8/</u>	4,360	7 <u>10/</u>	6,860
STOCKTON	<u>3</u>	<u>3,950</u>	<u>3</u>	<u>3,950</u>	<u>4 11/</u>	<u>5,450</u>
TOTAL	8	7,540	12	11,040	18	18,040

- 1/ Four berths eliminated with development of Shipyard No. 3 for containers.
2/ Expansion of Schnitzer Brothers (metal scrap).
3/ Increased capacity due to expansion of C&H at Crockett (food); Two berths at Selby (primary metals); One berth at Hercules (primary metals).
4/ One berth at Hunters Point (ores).
5/ Two berths adjacent to West Point Slough (ores).
6/ One berth at Hercules (primary metals); One berth at Bethlehem Steel (metal scrap); Two berths at Mare Island Strait (metal scrap); Two berths at Mare Island Strait (food).
7/ Two berths at Collinsville-Rio Vista (primary metals).
8/ Wharf 9 and Wharf 10 (wood chips).
9/ Collinsville-Rio Vista: Two berths (primary metals); One berth (ores).
10/ Lake Washington fill area: One berth (wood chips); One berth (ores).
11/ One berth at Rough & Ready Island (ores).

Terminal facilities for handling petroleum coke can be met with terminal facilities at various sites, including Bethlehem Steel, Hercules, or Selby. Since each of these facilities would also be developed to meet the 2000-2020 time period terminal needs, a two berth facility at Selby and one berth at Hercules is chosen for this time frame (Plate 7). The existing scrap metal handling facility at the Port of Oakland is assumed to be expanded by one berth to meet projected cargo needs (Plate 4). The development scheme for the handling of dry bulk cargoes is presented in Table 14.

(2) Berthing requirements for 2020 include three for metallic and non-metallic ores; two for food products (sugar); one for petroleum coke; and three for metal scrap. It is assumed that the dry bulk ore requirements would be satisfied by one berth at the Port of San Francisco's Hunters Point (Plate 2) and two berths at Redwood City (Plate 3). The Hercules site (Plate 7) would be expanded by one berth for handling petroleum coke. Facilities for handling metal scrap are sited at Pinole Point and Mare Island Strait (Plate 7).

(3) There remains a need for a terminal facility to handle some 1.5 million tons of bulk sugar in the 2020 time frame. It was assumed that in the 1980-2000 time period the existing plant at Crockett was doubled in capacity. This would seem to be the limit of expansion at the present facility, thereby requiring an entirely new complex, including processing plant and marine terminal receiving facilities. The best location for this facility, based on available sites, appears to be at Mare Island Strait, in the vicinity of the Sperry Flour Mill Vallejo Wharf (Plate 7).

b. San Francisco Bay Area - Low Projection. Berthing requirements using the low level of commodity projections are one berth for food products (sugar); three berths for primary metals (petroleum coke); and one berth for metal scrap. The development scheme for the "low" projection is indicated on Table 15.

(1) One berth is required in 1980 for petroleum coke. As with the "medium" projection, this facility would be developed in the 1980-2000 time period, with a total of two berths needed to handle the projected waterborne commerce in this commodity group. A two berth facility at Selby is included in the development plan.

(2) The needs for the 2020 time frame include one berth each for food, petroleum coke, and metal scrap. Again, as before, the food and metal scrap berthing requirements would be accommodated through the expansion of existing facilities. One berth would be developed at the Port of Oakland for metal scrap and the sugar refining capacity at Crockett will be increased. An additional berth would be developed at Hercules for the petroleum coke requirement.

c. San Francisco Bay Area - High Projection. Requirements for new berthing facilities with this level of commodity projections total twenty-four berths; including seven for bulk ores; six for food (sugar); five for primary metals; and six for metal scrap. Table 16 presents the development scheme for the "high" projection.

(1) As with each level of waterborne commerce projection for the San Francisco Bay Area, one berth is required by 1980 to handle petroleum coke. This requires the development of a total of four berths

TABLE 15

DRY BULK CARGO HANDLING CAPABILITY
PRACTICAL MAXIMUM CAPACITY
(1,000 Short Tons Per Year)

LOW PROJECTION

<u>PORT AREA</u>	<u>1980</u>		<u>2000</u>		<u>2020</u>	
	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>
<u>SAN FRANCISCO BAY AREA</u>						
SAN FRANCISCO	1	720	1	720	1	720
REDWOOD CITY	4	2,200	4	2,200	4	2,200
OAKLAND	1	500	1	500	2 <u>3/</u>	1,000
ALAMEDA	-	-	-	-	-	-
RICHMOND	3 <u>1/</u>	450	3	450	3	450
SAN PABLO BAY	<u>5</u>	<u>2,320</u>	<u>7 2/</u>	<u>3,820</u>	<u>8 4/</u>	<u>5,570</u>
TOTAL	14	6,190	16	7,690	18	9,940
<u>DELTA AREA</u>						
WESTERN SAC.-S.J.	2	1,230	3 <u>5/</u>	1,980	4 <u>6/</u>	2,730
SACRAMENTO	3	2,360	3	2,360	3	2,360
STOCKTON	<u>3</u>	<u>3,950</u>	<u>3</u>	<u>3,950</u>	<u>4 7/</u>	<u>5,450</u>
TOTAL	8	7,540	9	8,290	11	10,540

1/ Four berths eliminated with development of Shipyard No. 3 for containers.

2/ Two berths at Selby (primary metals).

3/ Expansion of Schnitzer Brothers (metal scrap).

4/ Increased capacity due to expansion of C&H at Crockett;
One berth at Hercules (primary metals).

5/ One berth at Collinsville-Rio Vista (primary metals).

6/ One berth at Collinsville-Rio Vista (primary metals).

7/ One berth at Rough and Ready Island (ores).

TABLE 16

DRY BULK CARGO HANDLING CAPABILITY
PRACTICAL MAXIMUM CAPACITY
(1,000 Short Tons Per Year)

HIGH PROJECTION

<u>PORT AREA</u>	<u>1980</u>		<u>2000</u>		<u>2020</u>	
	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>
<u>SAN FRANCISCO BAY AREA</u>						
SAN FRANCISCO	1	720	2 <u>2/</u>	2,220	2	2,220
REDWOOD CITY	4	2,200	5 <u>3/</u>	3,700	6 <u>6/</u>	5,200
OAKLAND	1	500	2 <u>4/</u>	1,000	2	1,000
ALAMEDA	-	-	-	-	-	-
RICHMOND	3 <u>1/</u>	450	3	450	3	450
SAN PABLO BAY	<u>5</u>	<u>2,320</u>	<u>11 5/</u>	<u>7,820</u>	<u>20 7/8/</u>	<u>16,570</u>
TOTAL	14	6,190	23	15,190	33	25,440
<u>DELTA AREA</u>						
WESTERN SAC.-S.J.	2	1,230	5 <u>9/</u>	3,480	12 <u>12/</u>	9,730
SACRAMENTO	3	2,360	7 <u>10/</u>	6,360	13 <u>13/</u>	14,610
STOCKTON	<u>3</u>	<u>3,950</u>	<u>4 11/</u>	<u>5,450</u>	<u>4 14/</u>	<u>5,700</u>
TOTAL	8	7,540	16	15,290	29	30,040

- 1/ Four berths eliminated with development of Shipyard No. 3 for containers.
2/ One berth at Hunters Point (ores).
3/ One berth adjacent to West Point Slough (ores).
4/ Expansion of Schnitzer Brothers (metal scrap).
5/ Expansion of C&H at Crockett (food); One berth at Mare Island Strait (food); Two berths at Selby (primary metals); Two berths at Hercules (primary metals); One berth at Bethlehem Steel (metal scrap).
6/ One berth adjacent to West Point Slough (ores).
7/ Four berths at Mare Island Strait (food-expansion of "2000" facility); One berth at Mare Island Strait (primary metals); Two berths at Mare Island Strait (ores); One berth at Mare Island Strait (metal scrap); One berth at Bethlehem Steel (metal scrap).
8/ Unmet berthing needs (2-ores, 2-metal scrap) to be met in Delta Area (Collinsville-Rio Vista).
9/ Three berths at Collinsville-Rio Vista (primary metals).
10/ Wharf 9 and Wharf 10 (wood chips); Two berths at Washington Lake fill area (wood chips).
11/ One berth at Rough and Ready Island (ores).
12/ Collinsville-Rio Vista: Three berths (primary metals); Two berths (metal scrap); Two berths (ores).
13/ Increased capacity at grain elevator; Six berths along Sacramento Ship Channel (4-ores, 2-wood chip).
14/ Increased capacity at grain elevator.

in the 1980-2000 time period. These needs are satisfied by two berths at Selby and two at Hercules. With approximately 1.5 million tons of sugar remaining to be handled it is expected that the present facility at Crockett would be expanded and one berth would be developed at Mare Island Strait (Plate 7). The two berths required for the handling of bulk ores are provided by one berth each at the Port of San Francisco (Hunters Point) and the Port of Redwood City. One berth for metal scrap is provided by the expansion of Schnitzer Brothers at the Port of Oakland (Plate 4).

(2) Of the total number of fourteen dry bulk berths required for the 2000-2020 time period, ten can be supplied in the San Francisco Bay Area. Based on a preliminary analysis of available waterfront property, four berths would have to be developed outside the subarea; probably in the Delta Area portion of the San Francisco Bay Region. This matter will be discussed in subsequent sections of this report.

(3) The most likely dry bulk berths to be developed within the subarea include one berth at Redwood City for ores (Plate 3); the expansion of the sugar processing complex at Mare Island Strait that was included in the 2000 development scheme (Plate 7); five additional berths at Mare Island Strait (Plate 7) for petroleum coke (one berth), ores (two berths), and metal scrap (one berth); and, one berth at Bethlehem Steel for metal scrap (Plate 7).

d. Delta Area - Medium Projection. The requirement for marine terminal facilities in the Delta Area would call for the development of new port areas. As was previously discussed, the Collinsville-Montezuma

Slough area has the potential for industrial and port related uses. At the present time two petro-chemical plants, which are in the planning stages, are sited in Solano County between Collinsville and Rio Vista. The reach of the Sacramento River extending from Collinsville to upstream of Rio Vista (Plate 10) has been included in the development scheme for the Delta Area. Another area for potential port use is along the Sacramento Ship Channel from approximately River Mile 40 to the Port of Sacramento deep-water turning basin (Plate 10). There is already some activity in this area with the potential development of approximately six thousand feet of water front footage for an industrial port. The impact of the development of these two areas, both economic and environmental, will have to be very carefully assessed. This will be reserved for future studies. The development scheme for the medium projection is shown on Table 14.

(1) With each of the three levels of waterborne commerce for the Delta Area, one berth is required in the 1980 time frame for primary metals (petroleum coke). As with the San Francisco Bay Area, these facilities would be developed in the 1980-2000 time period and be included in the "2000" column of each table delineating the development scheme. For the 2000 time frame the two petroleum coke berths would be developed in the Collinsville-Rio Vista area (Plate 10). Without further detailed studies and some input from the private sector it is not possible at this time to locate specific development sites. For the purposes of this report it has been assumed that there is sufficient

land area in both of the designated new port areas to accommodate projected facilities. Wharf 9 and Wharf 10 at the Port of Sacramento are selected to satisfy the 2000 requirement for wood chips (Plate 11).

(2) Berthing requirements for 2020 call for three bulk ore berths; one berth for wood chips; and two berths for primary metals. These requirements are expected to be satisfied by two berths at the Port of Sacramento, at the Lake Washington fill area (Plate 11); one berth on Rough and Ready Island at the Port of Stockton (Plate 12); and, three berths in the Collinsville-Rio Vista area (Plate 10).

e. Delta Area - Low Projection. The berthing requirements for dry bulk terminal facilities using the low projection are two for primary metals and one for bulk ores. As shown on Table 15, the need would be satisfied by two berths in the Collinsville-Rio Vista Area (Plate 10), and one berth at the Port of Stockton's Rough and Ready Island (Plate 12).

f. Delta Area - High Projection. The development sequence for the "high" projection level is shown on Table 16. Using the high projection would require a total of eleven additional berths, including four berths which could not be accommodated in the San Francisco Bay Area portion of the study area.

(1) The 2000 time frame needs are satisfied by siting four berths at the Port of Sacramento (Plate 11) for handling wood chips; one bulk ore berth at Rough and Ready Island (Plate 12); and three berths in the Collinsville-Rio Vista area (Plate 10) for petroleum coke.

(2) A total of thirteen additional berths are required for the 2000-2020 time period. Increased "farm product" tonnage in the Delta Area would be accommodated by increasing the rail and truck receiving facilities at the Ports of Sacramento and Stockton (Plates 11 and 12). Three petroleum coke berths; two metal scrap berths; and two bulk ore berths are in the development plan for the Collinsville-Rio Vista area (Plate 10). The six berths remaining to be included in the plan are sited along the Sacramento Ship Channel (Plate 10) and will handle wood chips (2-berths) and ores (4-berths).

47. LIQUID BULK TERMINALS

New facility requirements for liquid bulk terminals are for "food products" in the San Francisco Bay Area and "chemical" and "petroleum products" in the Delta Area. The allocation of projected liquid bulk cargo to the individual port areas is presented in Table 17.

a. San Francisco Bay Area. With the "medium" and the "low" projections the requirement is one berth each in the 2020 time frame. Using the "high" level projection the need is one berth in both the 2000 and 2020 time frames. The throughput capacity for the existing liquid bulk terminals is constrained by the commodity storage capacity. In analyzing these facilities it was determined that by increasing the storage capacity of each of the existing terminals the projected water-borne commerce can be handled without the construction of additional berths. The development scheme for the medium, low, and high projections are presented in Tables 18, 19, and 20 respectively.

TABLE 17

ALLOCATION OF PROJECTED
LIQUID BULK CARGO 1/
(1,000 Short Tons Per Year)

PORT AREA	MEDIUM			LOW			HIGH		
	1980	2000	2020	1980	2000	2020	1980	2000	2020
<u>SAN FRANCISCO BAY AREA</u>									
SAN FRANCISCO	30	80	120	30	70	100	40	100	160
REDWOOD CITY	150	80	70	140	30	0	170	170	220
OAKLAND	-	-	-	-	-	-	-	-	-
ALAMEDA	80	150	220	70	120	160	90	190	310
RICHMOND	2,180	1,720	2,020	2,040	970	920	2,600	3,040	4,510
SAN PABLO BAY	<u>4,500</u>	<u>2,410</u>	<u>2,000</u>	<u>4,220</u>	<u>870</u>	<u>0</u>	<u>5,370</u>	<u>5,160</u>	<u>6,900</u>
TOTAL	6,940	4,440	4,430	6,500	2,060	1,180	8,270	8,660	12,100
<u>DELTA AREA</u>									
<u>WESTERN SAC.-S.J.</u>									
SACRAMENTO	-	-	-	-	-	-	-	-	-
STOCKTON	<u>730</u>	<u>600</u>	<u>640</u>	<u>710</u>	<u>520</u>	<u>530</u>	<u>750</u>	<u>690</u>	<u>770</u>
TOTAL	2,140 ^{2/}	4,480	4,720	2,120 ^{3/}	3,890	3,860	2,160 ^{4/}	5,130	5,680

1/ Allocation of waterborne commerce based on berthing facilities operating at 90% of practical maximum capacity.

2/ Unmet demand: Projection = 4,610,000 short tons

3/ Unmet demand: Projection = 4,540,000 short tons

4/ Unmet demand: Projection = 4,740,000 short tons

TABLE 18

LIQUID BULK CARGO HANDLING CAPABILITY 1/
PRACTICAL MAXIMUM CAPACITY
(1,000 Short Tons Per Year)

MEDIUM PROJECTION

<u>PORT AREA</u>	<u>1980</u>		<u>2000</u>		<u>2020</u>	
	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>
<u>SAN FRANCISCO BAY AREA</u>						
SAN FRANCISCO	1	80	1	80	1	120 <u>2/</u>
REDWOOD CITY	- <u>3/</u>	600	- <u>3/</u>	600	- <u>3/</u>	600
OAKLAND	-	-	-	-	-	-
ALAMEDA	1	240	1	240	1	320 <u>2/</u>
RICHMOND	10	8,400	10	8,400	10	8,700 <u>2/</u>
SAN PABLO BAY	10	18,200	10	18,200	10	18,200
TOTAL	22	27,520	22	27,520	22	27,940
<u>DELTA AREA</u>						
WESTERN SAC.-S. F.	2	1,400	6 <u>4/</u>	9,400	6	9,400
SACRAMENTO	-	-	-	-	-	-
STOCKTON	5	1,000	5	1,000	5	1,000
TOTAL	7	2,400	11	10,400	11	10,400

1/ Excludes crude petroleum.2/ Expansion of existing terminal facilities.3/ Liquid bulk handled at general cargo terminal.4/ Two berths at Dow Chemical Co.; Two berths at Arco Chemical Co.

TABLE 19

LIQUID BULK CARGO HANDLING CAPABILITY 1/
 PRACTICAL MAXIMUM CAPACITY
 (1,000 Short Tons Per Year)

LOW PROJECTION

<u>PORT AREA</u>	<u>1980</u>		<u>2000</u>		<u>2020</u>	
	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>
<u>SAN FRANCISCO BAY AREA</u>						
SAN FRANCISCO	1	80	1	80	1	100 <u>2/</u>
REDWOOD CITY	- <u>3/</u>	600	- <u>3/</u>	600	- <u>3/</u>	600
OAKLAND	-	-	-	-	-	-
ALAMEDA	1	240	1	240	1	270 <u>2/</u>
RICHMOND	10	8,400	10	8,400	10	8,520 <u>2/</u>
SAN PABLO BAY	<u>10</u>	<u>18,200</u>	<u>10</u>	<u>18,200</u>	<u>10</u>	<u>18,200</u>
TOTAL	22	27,520	22	27,520	22	27,690
<u>DELTA AREA</u>						
WESTERN SAC.-S.J.	2	1,400	6 <u>4/</u>	9,400	6	9,400
SACRAMENTO	-	-	-	-	-	-
STOCKTON	<u>5</u>	<u>1,000</u>	<u>5</u>	<u>1,000</u>	<u>5</u>	<u>1,000</u>
TOTAL	7	2,400	11	10,400	11	10,400

1/ Excludes crude petroleum.

2/ Expansion of existing terminal facilities.

3/ Liquid bulk handled at general cargo terminal.

4/ Two berths at Dow Chemical Co.; Two berths at Arco Chemical Co.

TABLE 20

LIQUID BULK CARGO HANDLING CAPABILITY 1/
PRACTICAL MAXIMUM CAPACITY
(1,000 Short Tons Per Year)

HIGH PROJECTION

<u>PORT AREA</u>	<u>1980</u>		<u>2000</u>		<u>2020</u>	
	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>	<u>BERTHS</u>	<u>CAPACITY</u>
<u>SAN FRANCISCO BAY AREA</u>						
SAN FRANCISCO	1	80	1	160 <u>2/</u>	1	160
REDWOOD CITY	- <u>3/</u>	600	- <u>3/</u>	600	- <u>3/</u>	600
OAKLAND	-	-	-	-	-	-
ALAMEDA	1	240	1	380 <u>2/</u>	1	380
RICHMOND	10	8,400	10	8,980 <u>2/</u>	10	8,980
SAN PABLO BAY	<u>10</u>	<u>18,200</u>	<u>10</u>	<u>18,200</u>	<u>10</u>	<u>18,200</u>
TOTAL	22	27,520	22	28,320	22	28,320
<u>DELTA AREA</u>						
WESTERN SAC.-S.J.	2	1,400	6	9,400	6	9,400
SACRAMENTO	-	-	-	-	-	-
STOCKTON	<u>5</u>	<u>1,000</u>	<u>5</u>	<u>1,000</u>	<u>5</u>	<u>1,000</u>
TOTAL	7	2,400	11	10,400	11	10,400

1/ Excludes crude petroleum.

2/ Expansion of existing terminal facilities.

3/ Liquid bulk handled at general cargo terminal.

4/ Two berths at Dow Chemical Co.; Two berths at Arco Chemical Co.

b. Delta Area. "Chemicals" and "petroleum products" are the two commodities requiring berths in the Delta Area. This requirement is associated with the new petrochemical plants proposed for development along the Sacramento River in the Collinsville-Rio Vista area. The projected waterborne commerce for these developments is in the 1980 time frame, however, the docking facilities are shown as being developed in the 1980-2000 time period. Tables 18, 19, and 20 present the development scheme for the three levels of projected waterborne commerce.

NAVIGATION CHANNEL REQUIREMENTS

48. NAVIGATION OVERVIEW

The entrance to the Bay-Delta port complex is the mile-wide Golden Gate which is approximately 640 statute miles south of the mouth of the Columbia River and 420 miles north of Los Angeles. The entrance can be entered through one of three channels - the Bonita Channel, parallel to the coast north of Point Bonita; the main ship channel, which crosses the San Francisco Bar from a southwest direction; and the south channel, parallel to the coast south of Point Lobos. The San Francisco Bar is a submerged sandbar extending in an arc outside the Golden Gate at a distance of about five miles. The main ship channel through the Bar is 2,000 feet wide and 55 feet deep (MLLW). Inside the Bay, controlling depths in navigation channels are 35 feet deep (MLLW) in the Central Bay, San Pablo Bay and Suisun Bay. The South Bay Channel through San Bruno Shoal to Redwood City is 30 feet deep (MLLW) (Plate 13). Both the Sacramento and Stockton Ship Channels are also 30 feet deep (MLLW) (Plates 10 and 14). The commercial ports and numerous other public and

private facilities in the Bay-Delta complex are served by approximately 160 miles of Federally-constructed and maintained navigation channels. About 80 percent of these channels are dredged to depths in excess of 30 feet (MLLW). Pertinent information on existing navigation channels serving commerce in the San Francisco Bay and Delta area is presented in Table 21.

49. AUTHORIZED STUDIES

Under existing authorizations, approximately 100 miles of channels are to be improved and maintained to depths in the 35- to 55-foot (MLLW) range.

a. San Francisco Bay Area. Within the San Francisco Bay Area there are five separate authorized studies for channel improvements. These include Islais Creek (Port of San Francisco), John F. Baldwin Ship Channel, Oakland Outer Harbor, Richmond Harbor, and Redwood City Harbor (currently inactive). The Islais Creek study is investigating the feasibility of extending the entrance to the Islais Creek Channel and the deepening of a section of the existing approach area. Studies at the Ports of Oakland and Richmond are looking at port access channel improvements from previously-authorized depths of 35 feet (MLLW) to the 40- to 45-foot (MLLW) range. When the Redwood City Harbor study is resumed, it will consider increasing the present channel depths to greater than 30 feet (MLLW). The John F. Baldwin Ship Channel Project is studying the feasibility of deepening existing channels through the Central Bay, San Pablo Bay, and Suisun Bay to 45 feet (MLLW).

TABLE 21

EXISTING NAVIGATION DEVELOPMENT SAN FRANCISCO BAY AND DELTA AREA

PROJECT	AUTHORITY	NAVIGATION FEATURES
<u>DEEP DRAFT:</u>		
SAN FRANCISCO HARBOR	RIVER & HARBOR ACTS 1927 TO 1965	CHANNEL 55 FEET DEEP AND 2000 FEET WIDE THROUGH THE SAN FRANCISCO BAR; APPROACH CHANNEL ISLAIS CREEK, 35 FEET DEEP; AND, A CHANNEL 750 FEET WIDE AND 10 FEET DEEP TO SAN FRANCISCO AIRPORT ENDING IN A BASIN ABOUT 2000 FEET AND 10 FEET DEEP. ALL PROJECTS COMPLETED.
REDWOOD CITY HARBOR	RIVER & HARBOR ACTS 1910 TO 1950	CHANNEL 500 FEET WIDE AND 30 FEET DEEP ACROSS SAN BRUNO SHOAL; CHANNEL 300 FEET WIDE AND 30 FEET DEEP TO THE APPROXIMATE VICINITY OF THE CONFLUENCE OF WESTPOINT SLOUGH AND REDWOOD CREEK; TURNING BASIN AT THAT LOCATION 2,200 FEET LONG AND FROM 400 TO 900 FEET WIDE; CHANNEL 400 FEET WIDE, 30 FEET DEEP AND 1300 FEET LONG, WIDENING INTO A SECOND TURNING BASIN 900 FEET WIDE, 1,700 FEET LONG AND 30 FEET DEEP; AND A SHALLOW CHANNEL 150 FEET WIDE AND 5 FEET DEEP EXTENDING TO STEINBERGER SLOUGH. ALL PROJECTS COMPLETED.
OAKLAND HARBOR	RIVER & HARBOR ACTS 1922 TO 1962	CHANNEL IN THE OUTER HARBOR 35 FEET DEEP AND 600 TO 950 FEET WIDE, INCLUDING A TURNING BASIN 35 FEET DEEP AND 950 FEET WIDE; CHANNEL IN THE INNER HARBOR 30 FEET DEEP VARYING FROM 275 TO 800 FEET IN WIDTH TO THE PARK STREET BRIDGE AND CONTINUING AT A DEPTH OF 18 FEET AND A WIDTH OF 275 FEET THROUGH THE TIDAL CANAL TO SAN LEANDRO BAY; CHANNEL 25 FEET DEEP AND 300 FEET WIDE AT THE NORTH END OF BROOKLYN BASIN; A NORTH JETTY AND A SOUTH JETTY AT THE ENTRANCE OF THE INNER HARBOR, 9,500 FEET AND 12,000 FEET RESPECTIVELY; AND, FOUR BRIDGES ACROSS THE TIDAL CANAL, TWO OF WHICH HAVE BEEN REPLACED BY LOCAL INTERESTS TO MEET TRAFFIC NEEDS FOR ENLARGED HIGHWAY CROSSINGS. ALL PROJECTS COMPLETED EXCEPT DEEPENING OF THE TIDAL CANAL.
RICHMOND HARBOR	RIVER & HARBOR ACTS 1917 TO 1965	CHANNEL 35 FEET DEEP AND 600 FEET WIDE THROUGH SOUTHAMPTON SHOAL TO THE OUTER HARBOR; ENTRANCE CHANNEL TO THE INNER HARBOR 35 FEET DEEP AND 600 FEET WIDE TO A TURNING BASIN AT POINT RICHMOND, THENCE CONTINUING AT THE 35 FOOT DEPTH WITH A WIDTH OF FROM 500 TO 600 FEET TO POINT PORTRERO; AN INNER HARBOR CHANNEL 35 FEET DEEP AND 850 FEET WIDE TO THE ENTRANCE OF THE SANTA FE CHANNEL AND CONTINUING AT A DEPTH OF 30 FEET THROUGH THE SANTA FE CHANNEL AND THE TURNING BASIN; A RUBBLE MOUND TRAINING WALL 10,000 FEET LONG (PARALLEL TO THE CHANNEL BETWEEN POINT RICHMOND AND POINT PORTRERO) EXTENDING WESTERLY FROM BROOKS ISLAND; AN APPROACH AREA 32 FEET DEEP IN THE OUTER HARBORS AT POINT ORIENT AND POINT SAN PABLO; A CHANNEL 20 FEET DEEP, 150 FEET WIDE AND ABOUT 2,000 FEET LONG ALONG THE NORTH SIDE OF POINT SAN PABLO; AND A MANEUVERING AREA AT THE RICHMOND LONG WHARF 35 FEET DEEP. ALL PROJECTS COMPLETED.
SAN PABLO BAY AND MARE ISLAND STRAIT.	RIVER & HARBOR ACTS 1902 TO 1965	CHANNEL 35 FEET DEEP, 600 FEET WIDE AND ABOUT EIGHT MILES LONG IN SAN PABLO BAY ACROSS THE PINOLE SHOAL; A CHANNEL 30 FEET AND 700 FEET WIDE THROUGH MARE ISLAND STRAIT TO A TURNING BASIN ABOUT 1,000 FEET WIDE BETWEEN VALLEJO AND MARE ISLAND, AND TWO APPROACH AREAS 20 FEET DEEP TO THE WATERFRONTS AT VALLEJO; AND FOR MAINTENANCE BY THE CORPS OF ENGINEERS OF TWO APPROACH AREAS TO THE NAVY YARD PIERS AT THE SOUTHERN END OF MARE ISLAND.
CARQUINEZ STRAIT AND SUISUN BAY	RIVER & HARBOR ACTS 1927 TO 1965	NAVIGATION CHANNEL THROUGH THE UPPER REACHES OF CARQUINEZ STRAIT AND THE LOWER SUISUN BAY 30 FEET DEEP AND 200 FEET WIDE TO CHIPPS ISLAND. ALL PROJECTS COMPLETED.
SAN JOAQUIN RIVER AND PORT OF STOCKTON	RIVER & HARBOR ACTS 1927 TO 1960	30 FOOT CHANNEL, 400 FEET WIDE, FROM SUISUN BAY AT PITTSBURG TO VENICE ISLAND AND 225 FEET WIDE FROM VENICE ISLAND TO STOCKTON; CHANNEL IMPROVEMENTS AT STOCKTON AND OTHER RELATED DEVELOPMENTS. ALL PROJECTS COMPLETED.
SACRAMENTO DEEP WATER SHIP CHANNEL AND PORT OF SACRAMENTO	RIVER & HARBOR ACT 1946	CHANNEL 30 FEET DEEP, 43 MILES LONG FROM DEEP WATER IN SUISUN BAY TO SACRAMENTO; AND A TRIANGULAR HARBOR AND TURNING BASIN 2000 FEET BY 4,000 FEET AND 30 FEET DEEP AT LAKE WASHINGTON. THE SHIP CHANNEL FOLLOWS WIDENED AND DEEPENED EXISTING CHANNELS IN THE LOWER SACRAMENTO RIVER AND CACHE SLOUGH AND AN EXCAVATED CHANNEL WITH A DEPTH OF 30 FEET AND A BOTTOM WIDTH OF 200 TO 300 FEET, NORTH TO THE PORT. ALL PROJECTS COMPLETED.
<u>SHALLOW DRAFT:</u>		
SAN RAFAEL CREEK PETALUMA RIVER NAPA RIVER	RIVER & HARBOR ACTS 1902 TO 1945	CHANNEL 6 FEET DEEP AND 100 FEET WIDE DREDGED IN SAN RAFAEL CREEK; CHANNEL 8 FEET DEEP AND 100 FEET WIDE IN THE PETALUMA RIVER; CHANNEL IN THE NAPA RIVER VARYING FROM A DEPTH OF 15 FEET AND A WIDTH OF 100 FEET IN THE LOWER REACHES TO A DEPTH OF 10 FEET AND A WIDTH OF 75 FEET IN THE UPPER REACHES. ALL PROJECTS COMPLETED.
SUISUN CHANNEL	RIVER & HARBOR ACTS 1910 & 1937	CHANNEL 8 FEET DEEP, 200 FEET WIDE AT ENTRANCE, 100-125 FEET WIDE REMAINING PART OF CHANNEL TO SUISUN CITY, 13 MILES NORTH OF MOUTH; AND A TURNING BASIN 275 FEET WIDE AND 600 FEET LONG. ALL PROJECTS COMPLETED.
SACRAMENTO RIVER	RIVER & HARBOR ACTS 1875 TO 1935	CHANNEL 10 FEET DEEP, 150-200 FEET BOTTOM WIDTH, FROM SUISUN BAY TO SACRAMENTO; CHANNEL 6 FEET DEEP BETWEEN SACRAMENTO AND COLUSA; CHANNEL 5 FEET DEEP BETWEEN COLUSA AND CHICO LANDING; AND A BARGE CANAL WITH NAVIGATION LOCKS, WITH MINIMUM DEPTH OF 13 FEET CONNECTING THE DEEP WATER SHIP CHANNEL TO THE SACRAMENTO RIVER. ALL PROJECTS COMPLETED.
MIDDLE RIVER	RIVER & HARBOR ACTS 1930 & 1935	CHANNELS 9 FEET DEEP AND 100 FEET WIDE IN MIDDLE RIVER BELOW BORDEN HIGHWAY BRIDGE; IN LATHAM SLOUGH BETWEEN MIDDLE RIVER AND EMPIRE CUT; AND IN EMPIRE CUT, WISKEY SLOUGH AND TURNER CUT BETWEEN MIDDLE RIVER AND SAN JOAQUIN RIVER.
MOKELUMNE RIVER	RIVER & HARBOR ACT 1884	CLEARING AND REMOVAL OF SNAGS AND OBSTRUCTIONS AND OCCASIONAL DREDGING OF SHOALS FROM MOUTH OF RIVER TO GALT-NEW HOPE BRIDGE, A DISTANCE OF 35 MILES, INCLUDING BOTH FORKS.
OLD RIVER	RIVER & HARBOR ACT 1937	CHANNELS RANGING FROM 5 TO 10 FEET DEEP EXTENDED ALONG OLD RIVER FROM ITS MOUTH NEAR VENICE ISLAND TO ITS SOURCE IN THE SAN JOAQUIN RIVER NEAR MOSSDALE.

b. Delta Area. Feasibility studies are currently authorized for improving both the Sacramento Ship Channel and the Stockton Ship Channel. The Stockton Channel study is being conducted under the San Francisco Bay to Stockton authorization, with a separate authorization for the Sacramento Ship Channel.

FUTURE STUDIES

50. FUTURE STUDIES

With the completion of this phase of the In-Depth Study, the remaining work involves the evaluation of the identified port development schemes through a series of impact assessment studies: including a Transportation Systems Assessment, an Environmental Assessment, a Socio-Economic Assessment, a National Defense Assessment, and an Institutional Assessment. The following paragraphs will briefly describe each of the impact assessment studies. More detail on each of the studies can be found in the San Francisco Bay Area In-Depth Study Revised Plan of Study, January 1975.

51. TRANSPORTATION SYSTEMS ASSESSMENT

The scope of the Transportation Systems Assessment is directed toward determining the probable influence of future port facility developments on the existing and future development of the integrally related elements of the regional transportation system. This study will assess the adequacy of the land and air transportation systems to transship the projected cargoes from the docks to their ultimate destinations under the various alternative port systems.

52. ENVIRONMENTAL ASSESSMENT

The Environmental Assessment will be in terms of the existing conditions and potential environmental implications of regional navigation development and their ultimate effect on the population. Beneficial and detrimental impacts induced by each alternative port system, including intermodal operations, will be assessed against the background of existing conditions. In the event of potentially detrimental developments, mitigative measures will also be studied. Emphasis will be given to the preclusion of developments which would involve the irreversible or irretrievable commitment of natural resources with adverse effects.

53. SOCIO-ECONOMIC ASSESSMENT

The Socio-Economic Assessment is concerned with two closely related impact areas, economic well-being and social well-being. The economic study will evaluate the direct and indirect economic costs and benefits associated with both existing port activities and the growth-inducing impacts of alternative port development schemes. The social well-being study will identify the impact of port development on the overall quality of life of the San Francisco Bay Region population. Emphasis will be given to the preclusion of developments which could be irreparably destructive to the social infrastructure of the region.

54. NATIONAL DEFENSE ASSESSMENT

The objective of this assessment will be to determine the adequacy of the alternative port systems to meet national defense requirements

b. Delta Area. Feasibility studies are currently authorized for improving both the Sacramento Ship Channel and the Stockton Ship Channel. The Stockton Channel study is being conducted under the San Francisco Bay to Stockton authorization, with a separate authorization for the Sacramento Ship Channel.

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The Socio-Economic Assessment is concerned with two closely related impact areas, economic well-being and social well-being. The economic study will evaluate the direct and indirect economic costs and benefits associated with both existing port activities and the growth-inducing impacts of alternative port development schemes. The social well-being study will identify the impact of port development on the overall quality of life of the San Francisco Bay Region population. Emphasis will be given to the preclusion of developments which could be irreparably destructive to the social infrastructure of the region.

54. NATIONAL DEFENSE ASSESSMENT

The objective of this assessment will be to determine the adequacy of the alternative port systems to meet national defense requirements

under existing and future conditions. The assessment will concentrate on the San Francisco Bay Region with a limited overview of the national defense network, as necessary, to define the role of the Bay Region ports within the national defense scenario.

55. INSTITUTIONAL ASSESSMENT

This study will build on the inventory of the existing institutional framework and assess it for its adequacy and compatibility with the various components of the alternative port systems.



LEGEND

- MAJOR COMMERCIAL AIRPORTS
- PUBLIC PORT AREAS



SAN FRANCISCO BAY AREA IN DEPTH STUDY CALIFORNIA

SAN FRANCISCO BAY REGION

U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO, CORPS OF ENGINEERS
 DRAWN: []
 TRACED: []
 CHECKED: []



LEGEND

- MAJOR COMMERCIAL AIRPORTS
- PUBLIC PORT AREAS

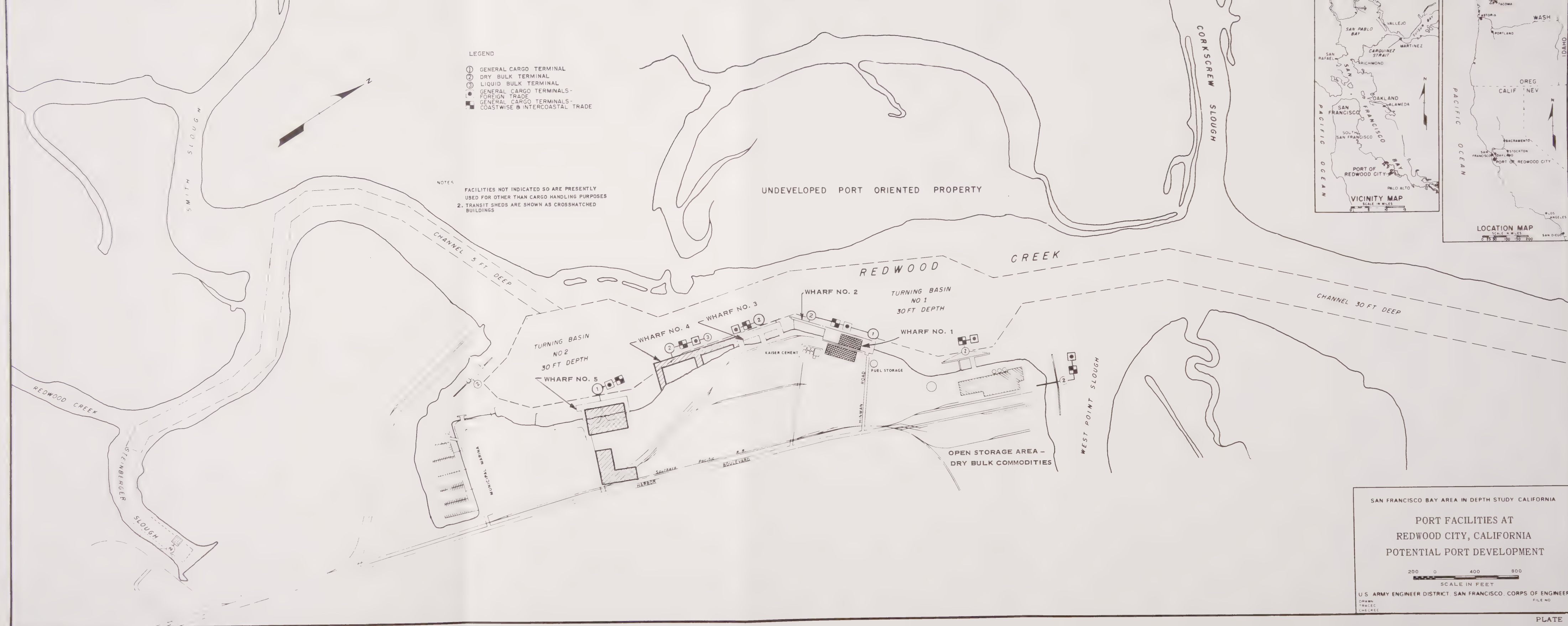


SAN FRANCISCO BAY AREA IN DEPTH STUDY CALIFORNIA

SAN FRANCISCO BAY REGION

U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO, CORPS OF ENGINEERS
 DRAWN
 TRACED
 CHECKED



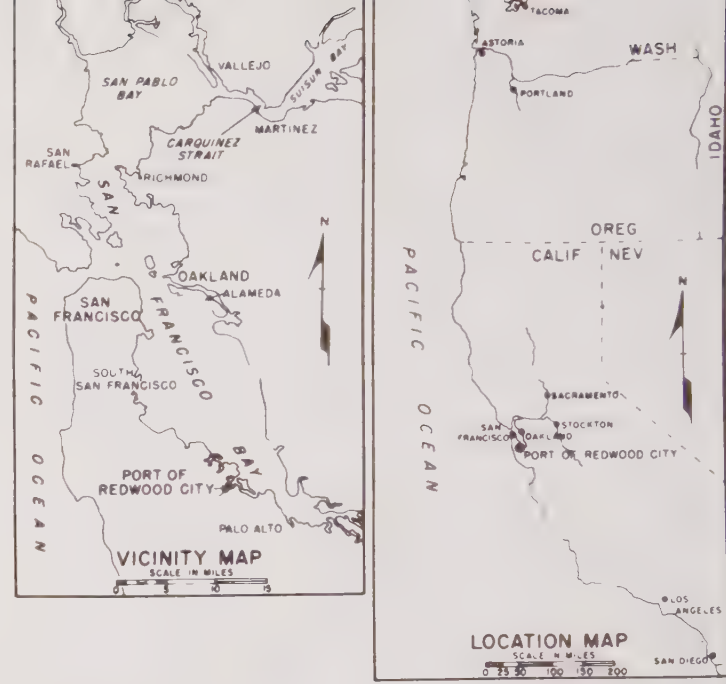


- LEGEND
- ① GENERAL CARGO TERMINAL
 - ② DRY BULK TERMINAL
 - ③ LIQUID BULK TERMINAL
 - ④ GENERAL CARGO TERMINALS- FOREIGN TRADE
 - ⑤ GENERAL CARGO TERMINALS- COASTWISE & INTERCOASTAL TRADE

NOTES

FACILITIES NOT INDICATED SO ARE PRESENTLY USED FOR OTHER THAN CARGO HANDLING PURPOSES

2. TRANSIT SHEDS ARE SHOWN AS CROSSHATCHED BUILDINGS



SAN FRANCISCO BAY AREA IN DEPTH STUDY CALIFORNIA

PORT FACILITIES AT
REDWOOD CITY, CALIFORNIA
POTENTIAL PORT DEVELOPMENT

200 0 400 800
SCALE IN FEET

U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO, CORPS OF ENGINEERS
DRAWN: TRACED: CHECKED:



BERKELEY CITY BOUNDARY

EMERYVILLE CITY BOUNDARY
OAKLAND CITY BOUNDARY

EMERYVILLE
Piles



500 0 500 1,000 1,500
Scale in feet

LEGEND

FILL INDUSTRIAL AREA

LEGEND

- ① GENERAL CARGO TERMINAL
- ② CONTAINER TERMINAL
- GENERAL CARGO TERMINALS FOREIGN TRADE
- GENERAL CARGO TERMINALS COASTWISE & INTERCOASTAL TRADE

BRIDGE

(TOLL BRIDGE)

HARBOR

Duck Club

Radio Towers
KSAY

Sewage Disposal

SAN FRANCISCO BAY AREA NA-DEPTH STUDY

PORT OF OAKLAND
POTENTIAL NORTH HARBOR
DEVELOPMENT

U.S. ARMY ENGINEER DIST. SAN FRANCISCO C. OF E.
DRAWN
TRACED
CHECKED



SAN FRANCISCO BAY AREA IN DEPTH STUDY CALIFORNIA

PORT FACILITIES AT RICHMOND, CALIFORNIA

POTENTIAL PORT DEVELOPMENT

0 1000 2000 3000
SCALE IN FEET

U.S. ARMY ENGINEER DISTRICT SAN FRANCISCO CORPS OF ENGINEERS
DRAWN: []
PAIRED: []
CHECKED: []



LEGEND



EXISTING FACILITIES

PRESENT USAGE

- BREAKBULK
- LIQUID BULK PETROLEUM PRODUCTS
- DRY BULK
- IMPORT/EXPORT AUTO



NEW DEVELOPMENT INCLUDING FILL

POTENTIAL USAGE

- CONTAINER
- IMPORT/EXPORT AUTO
- BREAKBULK AND BULK
- PETROLEUM PRODUCTS BULK
- TRUCK AND RAIL

SAN FRANCISCO BAY AREA IN-DEPTH STUDY

PORT OF BENICIA
POTENTIAL PORT DEVELOPMENT

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C. OF E.
DRAWN:
TRACED:
CHECKED:



LEGEND

- ① GENERAL CARGO TERMINAL
- ② DRY BULK TERMINAL
- ③ LIQUID BULK TERMINAL

NOTES:

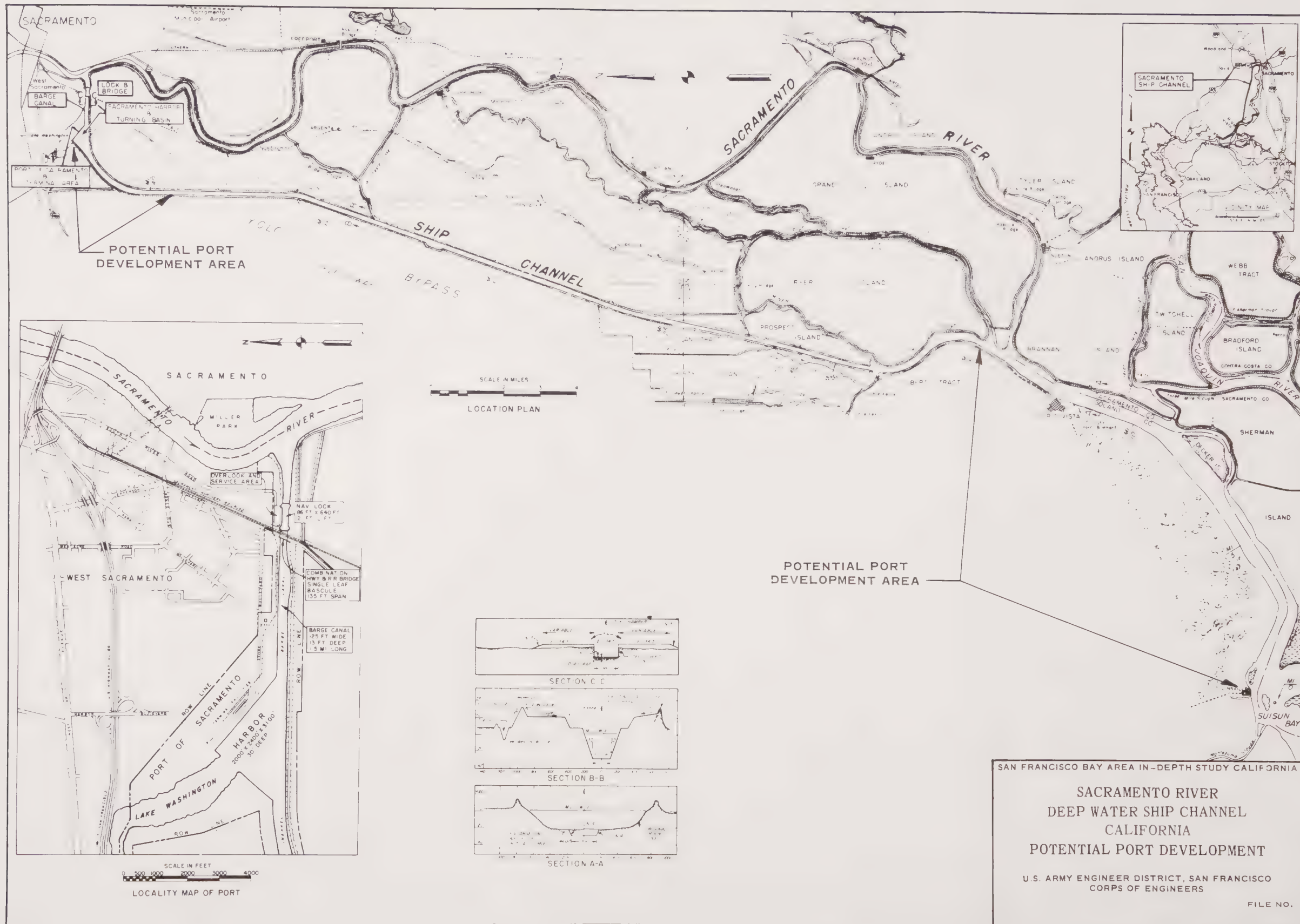
- 1 FACILITIES NOT INDICATED SO ARE PRESENTLY USED FOR OTHER THAN CARGO HANDLING PURPOSES

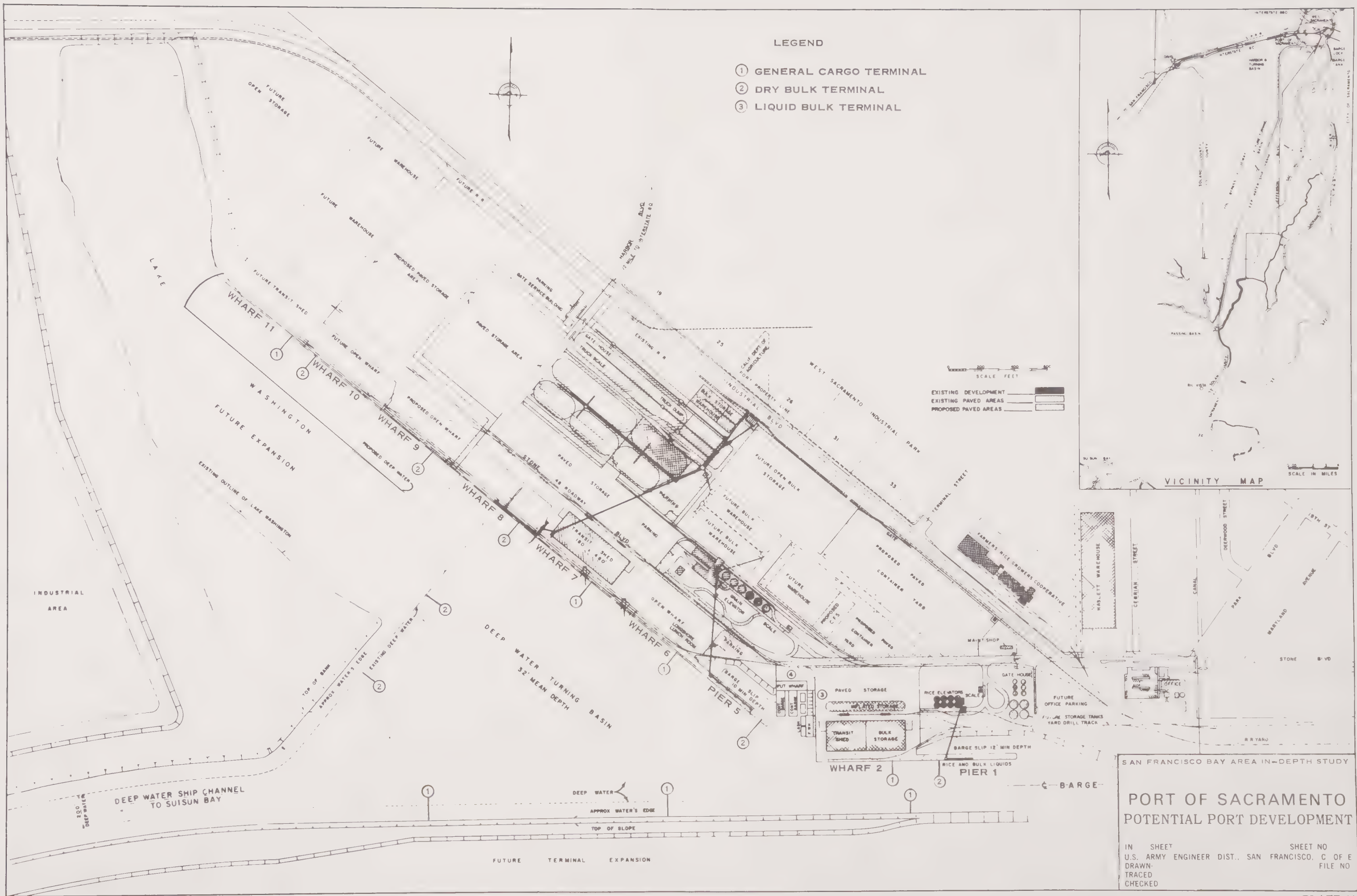
SAN FRANCISCO BAY AREA IN DEPTH STUDY CALIFORNIA

**PORT FACILITIES ON
THE WESTERN SACRAMENTO -
SAN JOAQUIN DELTA, CALIFORNIA
POTENTIAL PORT DEVELOPMENT**

0 500 1000 1500 2000
FEET

SHEET NO. 1
U.S. ARMY ENGINEER DISTRICT SAN FRANCISCO CORPS OF ENGINEERS
DATE: 1964
BY: J. L. H. REC.

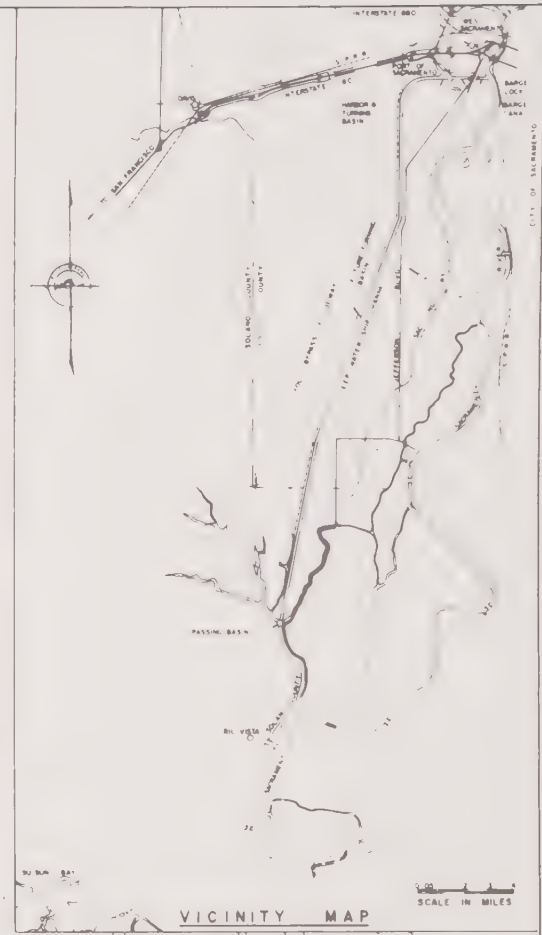




- LEGEND
- ① GENERAL CARGO TERMINAL
 - ② DRY BULK TERMINAL
 - ③ LIQUID BULK TERMINAL

SCALE FEET

EXISTING DEVELOPMENT
EXISTING PAVED AREAS
PROPOSED PAVED AREAS



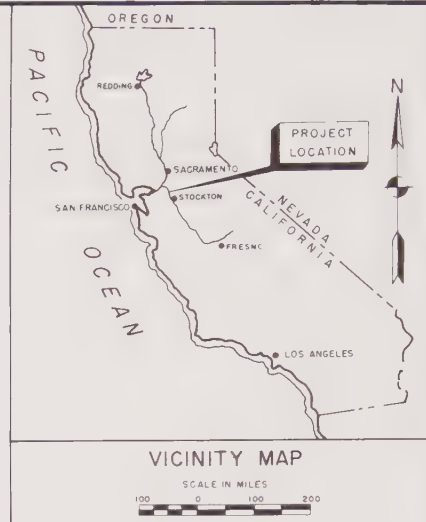
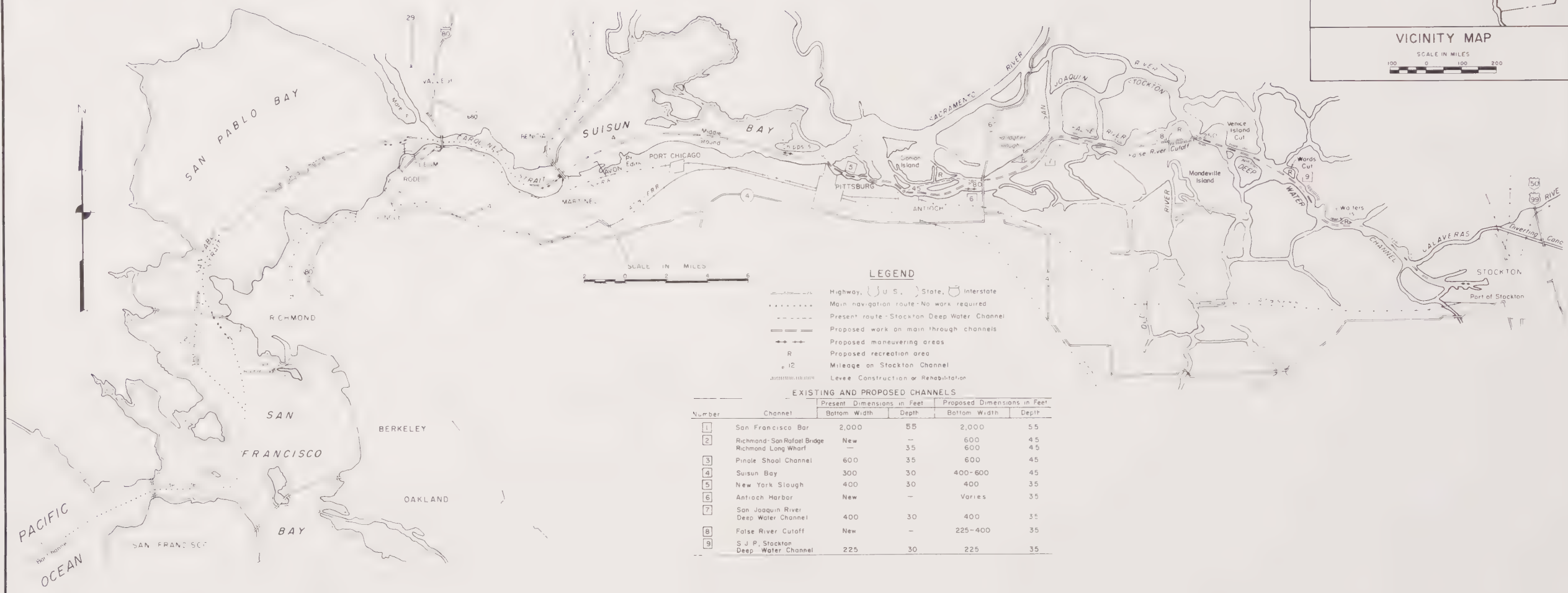
SAN FRANCISCO BAY AREA IN-DEPTH STUDY

**PORT OF SACRAMENTO
POTENTIAL PORT DEVELOPMENT**

IN SHEET
U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
DRAWN-
TRACED
CHECKED

SHEET NO
U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
FILE NO





- LEGEND**
- Highway, (U.S.) State, Interstate
 - Main navigation route - No work required
 - Present route - Stockton Deep Water Channel
 - Proposed work on main through channels
 - Proposed maneuvering areas
 - Proposed recreation area
 - Mileage on Stockton Channel
 - Levee Construction or Rehabilitation

EXISTING AND PROPOSED CHANNELS					
Number	Channel	Present Dimensions in Feet		Proposed Dimensions in Feet	
		Bottom Width	Depth	Bottom Width	Depth
1	San Francisco Bar	2,000	55	2,000	55
2	Richmond-San Rafael Bridge	New	35	600	45
	Richmond Long Wharf			600	45
3	Pineole Shoal Channel	600	35	600	45
4	Suisun Bay	300	30	400-600	45
5	New York Slough	400	30	400	35
6	Antioch Harbor	New	-	Varies	35
7	San Joaquin River Deep Water Channel	400	30	400	35
8	False River Cutoff	New	-	225-400	35
9	S. J. P. Stockton Deep Water Channel	225	30	225	35

SAN FRANCISCO BAY TO STOCKTON
(John F. Baldwin and Stockton Ship Channels)
 CALIFORNIA
 U.S. ARMY ENGINEER DISTRICT
 SACRAMENTO, CALIFORNIA
 FILE NO.

APPENDIX A

DEEP-DRAFT WATERBORNE COMMERCE

TABLE A-1

DEEP-DRAFT WATERBORNE COMMERCE
 BASE YEAR - 1972 1/
 (Thousands of short tons)

Method of Handling (Commodity Group)	San Francisco Bay Area	Delta Area	Total San Francisco Bay Region
Breakbulk			
General	3,232	143	3,375
Heavy-lift <u>2/</u>	<u>300</u>	<u>108</u>	<u>408</u>
Subtotal	3,532	251	3,783
Container/LASH	2,886	-	2,886
Dry Bulk			
Farm products	217	354	571
Metallic ores	60	24	84
Non-metallic minerals	730	409	1,139
Food	838	201	1,039
Lumber	-	514	514
Chemicals	6	110	116
Stone, Clay	16	-	16
Primary metals	503	110	613
Waste, scrap	<u>565</u>	<u>72</u>	<u>637</u>
Subtotal	2,935	1,794	4,729
Liquid Bulk			
Food	224	75	299
Pulp <u>3/</u>	65	78	143
Chemicals	81	77	158
Petroleum products	<u>14,204</u>	<u>165</u>	<u>14,369</u>
Subtotal	<u>14,574</u>	<u>395</u>	<u>14,969</u>
Total	23,927	2,440	26,367

1/ Includes all waterborne commerce except crude petroleum, inland waterways traffic (primarily sand, gravel and crushed rock; fresh fish and other marine products), and Department of Defense controlled cargo and special category items.

2/ Includes lumber and wood products and transportation equipment.

3/ Due to change in plant operation, pulp in slurry form no longer used.

TABLE A-2

DEEP-DRAFT WATERBORNE COMMERCE
SAN FRANCISCO BAY AREA 1/

HIGH PROJECTION
(Thousands of Short Tons)

Method of Handling (Commodity Group)	1980	2000	2020
Breakbulk			
General	3,309	3,268	5,343
Heavy-lift <u>2/</u>	<u>644</u>	<u>944</u>	<u>1,483</u>
Subtotal	<u>3,953</u>	<u>4,212</u>	<u>6,826</u>
Container/LASH	6,812	23,551	41,549
Dry Bulk			
Farm products	188	139	223
Metallic ores	257	920	2,820
Non-metallic minerals	934	2,876	8,712
Food	1,103	2,467	5,637
Lumber	-	-	-
Chemicals	-	-	-
Stone, clay	20	47	448
Primary metal	950	2,803	3,895
Waste, scrap	<u>992</u>	<u>2,078</u>	<u>4,106</u>
Subtotal	<u>4,444</u>	<u>11,330</u>	<u>25,841</u>
Liquid Bulk			
Food	368	943	1,612
Chemicals	32	143	381
Petroleum products	<u>7,873</u>	<u>7,571</u>	<u>10,111</u>
Subtotal	<u>8,273</u>	<u>8,657</u>	<u>12,104</u>
Total	23,482	47,750	86,320

1/ Excludes port areas of Sacramento and Stockton.

2/ Includes lumber and wood products and transportation equipment.

TABLE A-3

DEEP-DRAFT WATERBORNE COMMERCE
SAN FRANCISCO BAY AREA 1/

MEDIUM PROJECTION
(Thousands of Short Tons)

Method of Handling (Commodity Group)	1980	2000	2020
Breakbulk			
General	2,850	2,638	3,798
Heavy-lift <u>2/</u>	<u>567</u>	<u>837</u>	<u>1,282</u>
Subtotal	3,417	3,475	5,080
Container/LASH	5,939	18,915	32,012
Dry Bulk			
Farm products	159	101	146
Metallic ores	119	350	1,261
Non-metallic minerals	768	1,739	4,671
Food	924	1,665	3,345
Lumber	-	-	-
Chemicals	-	-	-
Stone, clay	18	33	407
Primary metals	859	2,283	3,176
Waste, scrap	<u>921</u>	<u>1,661</u>	<u>2,889</u>
Subtotal	3,768	7,832	15,895
Liquid Bulk			
Food	311	782	1,207
Chemicals	30	120	286
Petroleum products	<u>6,600</u>	<u>3,537</u>	<u>2,940</u>
Subtotal	<u>6,941</u>	<u>4,439</u>	<u>4,433</u>
Total	20,065	34,661	57,420

1/ Excludes port areas of Sacramento and Stockton.

2/ Includes lumber and wood products and transportation equipment.

TABLE A-4

DEEP-DRAFT WATERBORNE COMMERCE
SAN FRANCISCO BAY AREA 1/

LOW PROJECTION
(Thousands of Short Tons)

Method of Handling (Commodity Group)	1980	2000	2020
Breakbulk			
General	2,458	2,001	2,164
Heavy-lift <u>2/</u>	490	743	1,120
Subtotal	2,948	2,744	3,284
Container/LASH	5,189	14,720	24,080
Dry Bulk			
Farm products	132	62	70
Metallic ores	47	2	230
Non-metallic minerals	648	749	1,001
Food	819	1,134	1,773
Lumber	-	-	-
Chemicals	-	-	-
Stone, clay	17	26	387
Primary metals	764	1,675	2,458
Waste, scrap	854	1,262	1,735
Subtotal	3,281	4,910	7,654
Liquid Bulk			
Food	269	673	939
Chemicals	29	105	227
Petroleum products	6,202	1,281	11
Subtotal	6,500	2,059	1,177
Total	17,918	24,433	36,195

1/ Excludes port areas of Sacramento and Stockton.

2/ Includes lumber and wood products and transportation equipment.

TABLE A-5
DEEP-DRAFT WATERBORNE COMMERCE
DELTA AREA 1/

HIGH PROJECTION
(Thousands of Short Tons)

Method of Handling (Commodity Group)	1980	2000	2020
Breakbulk			
General	423	1,187	2,380
Heavy-lift <u>2/</u>	<u>100</u>	<u>333</u>	<u>416</u>
Subtotal	523	1,520	2,796
Container/LASH	-	-	-
Dry Bulk			
Farm products	380	226	282
Metallic ores	338	443	555
Non-metallic minerals	723	2,519	7,009
Food	604	1,142	1,489
Lumber	975	4,599	5,942
Chemicals	415	1,495	2,876
Stone, clay	-	-	-
Primary metals	1,091	2,346	4,101
Waste, scrap	<u>37</u>	<u>74</u>	<u>140</u>
Subtotal	4,563	12,844	22,394
Liquid Bulk			
Food	131	350	429
Chemicals	1,395	1,610	2,016
Petroleum	<u>3,209</u>	<u>3,170</u>	<u>3,236</u>
Subtotal	4,735	5,130	5,681
Total	9,821	19,494	30,871

1/ Includes port areas of Sacramento and Stockton.

2/ Includes lumber and wood products and transportation equipment.

TABLE A-6
DEEP-DRAFT WATERBORNE COMMERCE
DELTA AREA 1/

MEDIUM PROJECTION
(Thousands of Short Tons)

Method of Handling (Commodity Group)	1980	2000	2020
Breakbulk			
General	284	633	1,112
Heavy-lift <u>2/</u>	59	172	216
Subtotal	343	805	1,328
Container/LASH	-	-	-
Dry Bulk			
Farm products	318	157	185
Metallic ores	252	221	277
Non-metallic minerals	602	1,879	4,794
Food	537	998	1,211
Lumber	563	2,299	2,970
Chemicals	370	1,125	2,178
Stone, clay	-	-	-
Primary metals	961	1,740	2,752
Waste, scrap	35	60	100
Subtotal	3,638	8,479	14,467
Liquid Bulk			
Food	112	320	376
Chemicals	1,385	1,562	1,856
Petroleum products	3,113	2,594	2,493
Subtotal	4,610	4,476	4,725
Total	8,591	13,760	20,520

1/ Includes port areas of Sacramento and Stockton.

2/ Includes lumber and wood products and transportation equipment.

TABLE A-7

DEEP-DRAFT WATERBORNE COMMERCE
DELTA AREA 1/LOW PROJECTION
(Thousands of Short Tons)

Method of Handling (Commodity Group)	1980	2000	2020
Breakbulk			
General	198	279	420
Heavy-lift <u>2/</u>	<u>18</u>	<u>10</u>	<u>17</u>
Subtotal	216	289	437
Container/LASH	-	-	-
Dry Bulk			
Farm products	253	88	88
Metallic ores	166	-	2
Non-metallic minerals	514	1,308	2,695
Food	470	853	931
Lumber	150	-	-
Chemicals	336	784	1,630
Stone, clay	-	-	-
Primary metals	832	1,133	1,403
Waste, scrap	<u>33</u>	<u>46</u>	<u>60</u>
Subtotal	2,754	4,212	6,809
Liquid Bulk			
Food	93	296	342
Chemicals	1,381	1,535	1,755
Petroleum products	<u>3,063</u>	<u>2,056</u>	<u>1,764</u>
Subtotal	4,537	3,887	3,861
Total	7,507	8,388	11,107

1/ Includes port areas of Sacramento and Stockton.2/ Includes lumber and wood products and transportation equipment.

APPENDIX B
NEW FACILITY REQUIREMENTS

TABLE B-1

SAN FRANCISCO BAY AREA
NEW FACILITY REQUIREMENTS
(Number of Berths) 1/ 2/

METHOD OF HANDLING	TOTAL AS OF 1980 <u>3/</u>	INCREMENTAL REQUIREMENTS			TOTAL AS OF 2020
		<u>1980</u>	<u>2000</u>	<u>2020</u>	
Breakbulk					
General	50	0	0	0	50
Heavy-lift <u>4/</u>	<u>7</u>	<u>0</u>	<u>2</u>	<u>3</u>	<u>12</u>
Subtotal	57	0	2	3	62
Container/LASH	22	0	19	26	67
Dry Bulk					
Farm Products	1	0	0	0	1
Metallic & Non- metallic ores	4	0	0	3	7
Food (Sugar)	3	0	1	2	6
Lumber	-	-	-	-	-
Chemicals <u>5/</u>	-	-	-	-	-
Stone, Clay	1	0	0	0	1
Primary Metals	1	1	2	1	5
Waste, Scrap	<u>8</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>11</u>
Subtotal	18	1	4	8	31
Liquid Bulk <u>6/</u>					
Food	4	0	0	1	5
Chemicals <u>7/</u>	-	-	-	-	-
Petroleum Products	<u>18</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>18</u>
Subtotal	22	0	0	1	23
Total	119	1	25	38	183

1/ Based on "MEDIUM" waterborne commerce projection

2/ Based on existing technology

3/ Includes berths which are presently under construction as well as those considered likely to be operational by 1980

4/ Logs, lumber & transportation equipment

5/ Handled at non-metallic ore facilities

6/ Excludes crude petroleum

7/ Handled at petroleum product terminals

TABLE B-2

SAN FRANCISCO BAY AREA
NEW FACILITY REQUIREMENTS
(Number of Berths) 1/ 2/

METHOD OF HANDLING	TOTAL AS OF 1980 <u>3/</u>	INCREMENTAL REQUIREMENTS			TOTAL AS OF 2020
		1980	2000	2020	
Breakbulk					
General	50	0-0	0-0	0-5	50-55
Heavy-lift <u>4/</u>	<u>7</u>	<u>0-1</u>	<u>1-2</u>	<u>3-3</u>	<u>11-13</u>
Subtotal	57	0-1	1-2	3-8	61-68
Container/LASH	22	0-0	11-28	18-35	51-85
Dry Bulk					
Farm Products	1	0-0	0-0	0-0	1-1
Metallic & Non- metallic ores	4	0-0	0-2	0-5	4-11
Food (Sugar)	3	0-	0-2	1-4	4-9
Lumber	-	-	-	-	-
Chemicals <u>5/</u>	-	-	-	-	-
Stone, Clay	1	0-0	0-0	0-0	1-1
Primary Metals	1	1-1	1-3	1-1	4-6
Waste, Scrap	<u>8</u>	<u>0-0</u>	<u>0-2</u>	<u>1-4</u>	<u>9-14</u>
Subtotal	18	1-1	1-9	3-14	23-42
Liquid Bulk <u>6/</u>					
Food	4	0-0	0-1	1-1	5-6
Chemicals <u>7/</u>	-	-	-	-	-
Petroleum Products	<u>18</u>	<u>0-0</u>	<u>0-0</u>	<u>0-0</u>	<u>18-18</u>
Subtotal	22	0-0	0-1	1-1	23-24
Total	119	1-2	13-40	25-58	158-219

1/ Based on "LOW" and "HIGH" waterborne commerce projections

2/ Based on existing technology

3/ Includes berths which are presently under construction as well as those considered likely to be operational by 1980

4/ Logs, lumber & transportation equipment

5/ Handled at non-metallic ore facilities

6/ Excludes crude petroleum

7/ Handled at petroleum product terminals

TABLE B-3

DELTA AREA
NEW FACILITY REQUIREMENTS
(Number of Berths) 1/ 2/

METHOD OF HANDLING	TOTAL AS OF 1980 <u>3/</u>	INCREMENTAL REQUIREMENTS			TOTAL AS OF 2020
		1980	2000	2020	
Breakbulk					
General	9	0	0	0	9
Heavy-lift <u>4/</u>	<u>2</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>
Subtotal	<u>11</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>11</u>
Container/LASH	-	-	-	-	-
Dry Bulk					
Farm Products	3	0	0	0	3
Metallic & Non- metallic ores	3	0	0	3	6
Food <u>5/</u>	-	-	-	-	-
Lumber (woodchips)	1	0	2	1	4
Chemicals <u>6/</u>	-	-	-	-	-
Stone, Clay	-	-	-	-	-
Primary Metals	<u>7/</u>	1	1	2	4 <u>7/</u>
Waste, Scrap	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>
Subtotal	<u>8</u>	<u>1</u>	<u>3</u>	<u>6</u>	<u>18</u>
Liquid Bulk <u>8/</u>					
Food	1	0	0	0	1
Chemicals, Petroleum Products	<u>6</u>	<u>4</u>	<u>0</u>	<u>0</u>	<u>10</u>
Subtotal	<u>7</u>	<u>4</u>	<u>0</u>	<u>0</u>	<u>11</u>
Total	26	5	3	6	40

1/ Based on "MEDIUM" waterborne commerce projection

2/ Based on existing technology

3/ Includes berths which are presently under construction as well as those considered likely to be operational by 1980

4/ Logs, lumber & transportation equipment

5/ Prepared animal feed; handled a "Farm Product" terminals

6/ Handled at non-metallic ore facilities

7/ Some multiple-use facilities

8/ Excludes crude petroleum

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